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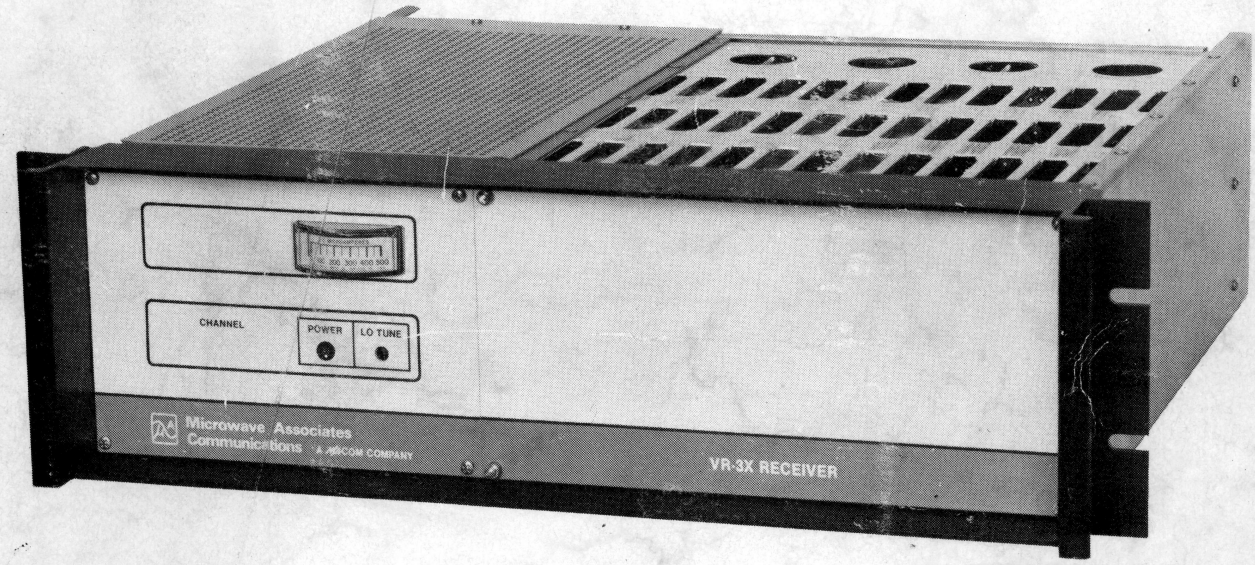
SEE NOTES IN OTHER MANUAL:
P5-35

VR-3X SATELLITE RECEIVER



INSTRUCTION MANUAL

MICROWAVE ASSOCIATES
COMMUNICATIONS
A MACOM COMPANY

SECTION 1
EQUIPMENT DESCRIPTION

GENERAL DESCRIPTION

Microwave Associates Communications (MAC) VR-3X Satellite Receiver (Figure 1-1) is a dual conversion, superheterodyne, satellite Receiver and covers the 3.7 to 4.2 GHz band. Tuning is done with a small screwdriver, extended through the front panel. A direct frequency dialing version, the VR-4X Satellite Receiver, is also available. Standard features include automatic frequency control (AFC), threshold extension demodulation (TED), and baseband video (including subcarriers) output.

Options include subcarrier demodulators, a cable modulator, and automatic vertical/horizontal antenna polarization switching.

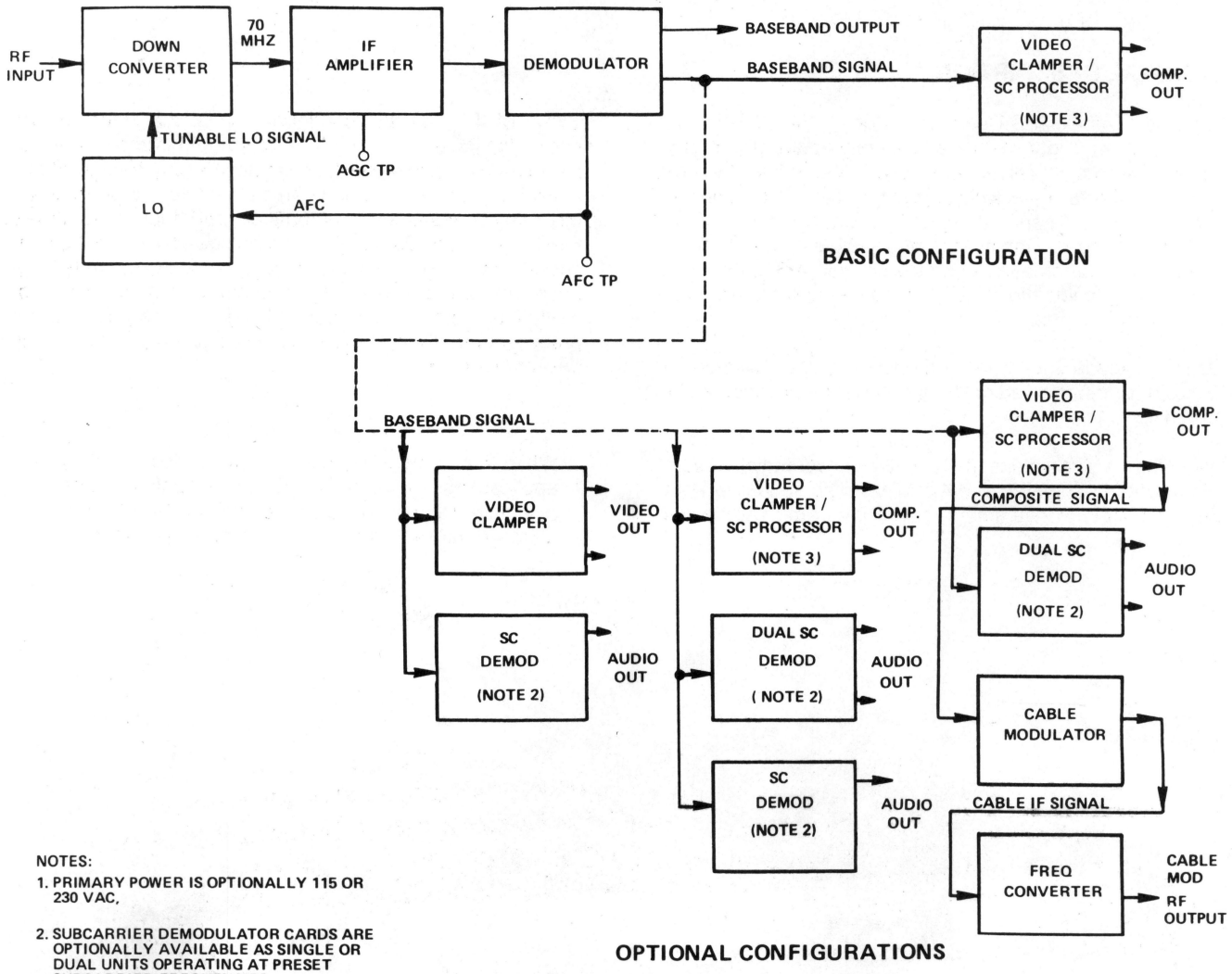
Using the proper options, the user can have audio, video or composite video (video and 4.5 MHz audio subcarrier) outputs and directly drive a cable television or microwave system.

Some of the possible configurations of the Receiver are shown in Figure 1-2. While the configurations shown are typical of many applications, they are not the only configurations available. Plug-in modules can be selected to produce almost any combination of outputs desired. Figure 1-3 shows the plug-in modules and the outputs possible when the configurations in Figure 1-2 are used. In each case, the RF signal is processed to produce a baseband output from the Demodulator card. This baseband signal undergoes further processing in each of the various typical configurations as described below.

NOTE

While the configurations shown are typical of many applications, they are not the only configurations available. Plug-in modules can be selected to produce virtually any combination of outputs desired.

Figure 1-1. VR-3X Satellite Receiver – Front View



NOTES:

1. PRIMARY POWER IS OPTIONALLY 115 OR 230 VAC,
2. SUBCARRIER DEMODULATOR CARDS ARE OPTIONALLY AVAILABLE AS SINGLE OR DUAL UNITS OPERATING AT PRESET SUBCARRIER FREQUENCIES.
3. VIDEO CLAMPER/SUBCARRIER PROCESSOR CARDS ARE AVAILABLE IN 6.2 MHz OR 6.8 MHz SUBCARRIER OPTIONS. COMPOSITE OUTPUTS ARE VIDEO PLUS 4.5 MHz AUDIO SUBCARRIER.

Figure 1-2. VR-3X Satellite Receiver – Simplified Block Diagram

BASIC CONFIGURATION. In the basic configuration, the baseband signal is fed to a combination Video Clamper/Subcarrier Processor card. Here, the Video Clamper circuit removes all subcarriers and the dispersal waveform from the baseband signal. The Subcarrier Processor circuit converts the program audio subcarrier present in the baseband signal to a 4.5 MHz subcarrier which is combined with the clamped video signal to produce two composite outputs (video plus 4.5 MHz audio subcarrier) at 1V P-P into 75 ohms unbalanced.

RECEIVER CONFIGURATION A. In this typical arrangement, two Subcarrier Demodulator cards have been added to the basic Receiver. These are available as single or dual output units. Operating at preset subcarrier frequencies, they supply one or two 600 ohm balanced audio outputs at maximum +9 dBm.

RECEIVER CONFIGURATION B. This configuration is similar to Configuration A, except that the second Subcarrier Demodulator card has been removed, and Cable Modulator and Frequency Converter cards have been installed. In this configuration, one of the two composite outputs from the Video Clamper/Subcarrier Processor card is fed to the Cable Modulator. This card produces an output consisting of a video carrier and an audio carrier at cable IF frequencies of 45.75 MHz and 41.25 MHz respectively. The Frequency Converter card is factory preset to convert the cable IF signal to the desired television channel frequencies. This Receiver configuration eliminates the need for an external Cable Modulator, and can directly feed a microwave system and a cable system simultaneously.

RECEIVER CONFIGURATION C. In this configuration, the Video Clamper/Subcarrier Processor card of the basic Receiver has been replaced by a Video Clamper card. This circuit removes all subcarriers and the dispersal waveform from the baseband signal producing two "clean" video outputs at 1V P-P into 75 ohms unbalanced. Audio subcarriers on the baseband signal can be processed by using single or dual Subcarrier Demodulator cards, identical to those described in Configuration A.

MECHANICAL DESCRIPTION

The VR-3X Satellite Receiver is designed for mounting in a standard 19″ EIA equipment rack. The enclosure is 19 inches wide by 18 inches deep by 5-1/4 inches (3 rack units) high (48.3 x 45.7 x 13.3 cm). The front of the Receiver has standard slotted rack panel mounts.

The Receiver front panel (Figure 1-4) is divided into two parts:

1. A fixed panel on which is mounted an AGC meter, a POWER ON indicator lamp, and a LO TUNE adjustment acess hole.

2. A removable panel which provides access to all plug-in modules and internal controls.

The Receiver mainframe contains the Downconverter, Local Oscillator, and Power Supply moduels in a compartment located behind the meter panel. These modules are accessible through the top of the unit with the top cover removed (Figure 1-5).

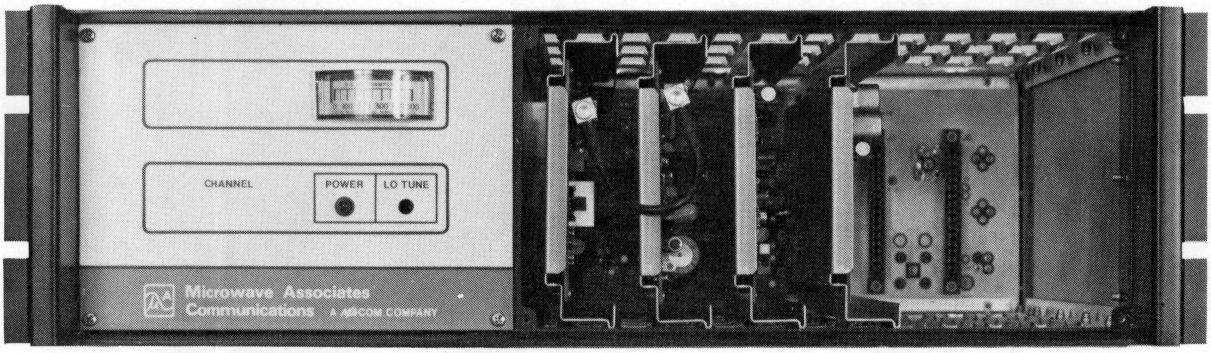


Figure 1-4. VR-3X Satellite Receiver – Front View (Door Open)

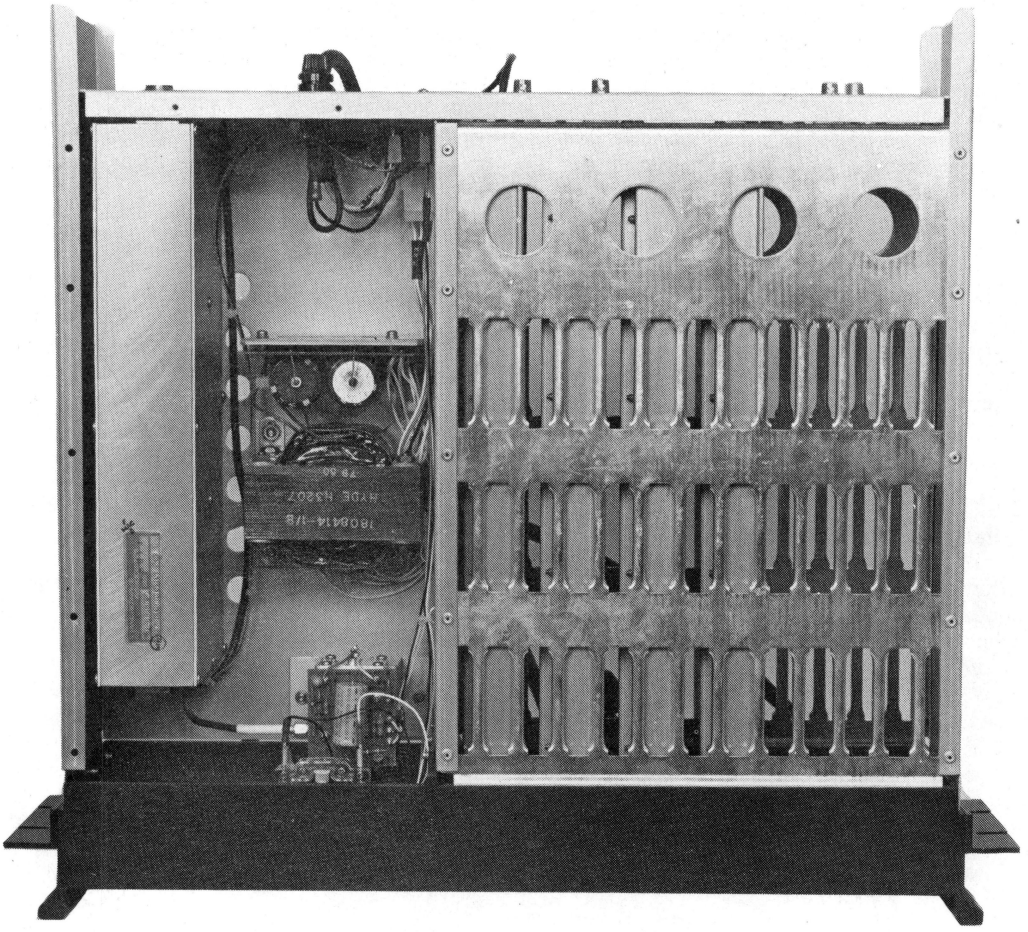


Figure 1-5. VR-3X Satellite Receiver – Top View

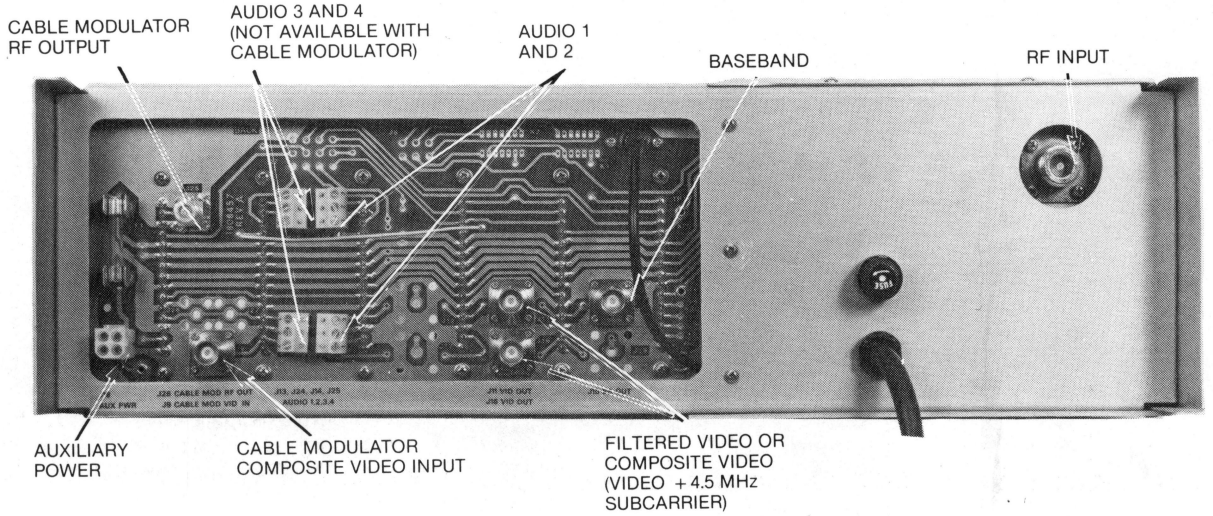

CABLE MODULATOR RF OUTPUT
AUDIO 3 AND 4 (NOT AVAILABLE WITH CABLE MODULATOR)
AUDIO 1 AND 2
BASEBAND
RF INPUT
AUXILIARY POWER
CABLE MODULATOR COMPOSITE VIDEO INPUT
FILTERED VIDEO OR COMPOSITE VIDEO (VIDEO + 4.5 MHz SUBCARRIER)

Figure 1-6. VR-3X Satellite Receiver – Rear View

THEORY OF OPERATION

GENERAL. A functional block diagram is shown in Figure 1-2 to aid in the discussion. Detailed schematics are included in Section 5 of the manual.

RF INPUT. The incoming RF signal from the receiving antenna/low noise amplifier (LNA) is accepted at a Type N coaxial connector, an integral part of thee Downconverter module on the rear of the Receiver.

TUNEABLE OSCILLATOR. The VR-3X Satellite Receiver can be manually tuned to receive any one of 24 satellite channels with a screwdriver adjustment tool. This feature eliminates the need to change crystals or to perform any other adjustment when changing channels. However, when changing to a channel on another antenna polarization (from horizontal to vertical or vice versa), it will be necessary to connect the feed line from the corresponding antenna/LNA to the Receiver's RF input connector accordingly.

The front panel LO TUNE screwdriver adjustment varies the frequency of the Local Oscillator across the band of 1.575 to 1.875 GHz. Since the LO signal is doubled by the anti-parallel diode mixer in the Downconverter module, the net effect is a heterodyning signal of twice the oscillator frequency that is 550 MHz below the frequency of the desired satellite channel. Automatic frequency control (AFC) locks the LO to the satellite signal. The AFC voltage is developed by a digital AFC circuit in the Demodulator card and applied to the oscillator biasing network.

3700 + (1575 · 2) = 550

4300 - (1875 · 2) = 550

DOWNCONVERTER

1st IF

Incoming signals in the 3.7 to 4.2 GHz range are bandpass filtered; other frequencies are attenuated, thereby preventing their introduction into the Mixer. A Ferrite Isolator following the Mixer provides a one-way signal path which aids in impedance matching and helps prevent radiation of the Local Oscillator (LO) signal from the Mixer.

The RF signal is now heterodyned with the second harmonic of the LO signal to produce the Receiver's first intermediate frequency (IF) signal of 550 MHz. The anti-parallel-diode Mixer functions as a doubler for the LO.

The 550 MHz Mixer IF output next passes through two amplifiers and a bandpass filter before it is applied to the second Mixer. The second LO operates at 480 MHz and the Mixer output is the second IF of 70 MHz.

2nd IF

The 70 MHz IF signal is applied to an IF Bandpass Filter formed by resonant LC circuits with a 70 MHz center frequency and a 3 dB bandwidth of 30 MHz. This is followed by an all-pass equalizer that has a variable center frequency with a phase response inverse to the normal filter response. The Downconverter uses broadband integrated circuit amplifiers to compensate for filter losses and produce an overall RF-to-IF gain of approximately 25 dB.

IF AMPLIFIER. The IF Amplifier card provides the major portion of the Receiver IF gain. An automatic gain control (AGC) circuit maintains the 70 MHz IF output level essentially constant at +2 dBm (+51 dBmV) over a 40 dB dynamic input range. The card also contains a Threshold Extension Demodulator (TED) circuit that provides a 3 dB threshold improvement when compared with a 30 MHz IF bandwidth.

The 70 MHz IF signal from the Downconverter module is coupled via a coaxial cable to the input connector at the rear of the card. The IF Amplifier has four, fixed gain integrated circuit amplifiers, each stage developing a gain of approximately 14 dB. The overall gain is controlled by varying the signal level into the first two IC amplifier stages. This is accomplished by applying an AGC voltage to a pair of low noise RF amplifiers which function as electronically controlled attenuators. The amount of attenuation is determined by the magnitude of the AGC which is proportional to the incoming signal level. AGC/MGC switch S1 and MGC potentiometer R16 located at the front edge of the card permit manual gain adjustment for certain tests.

The TED uses a digital phase-locked loop (PLL) to detect modulation of the 70 MHz IF carrier. As the 70 MHz carrier changes frequency due to modulation, the PLL tunes the series resonant filter to track the FM signal; this limits the noise bandwidth. This technique provides the Receiver with an effective IF bandwidth of 15 MHz, resulting in an improvement in threshold when compared with a 30 MHz IF bandwidth. The TED circuit may be disabled, for testing purposes, by connecting jumper plugs W1 across E1 and E2 and W2 across E4 and E5.

DEMODULATOR. The Demodulator card is a wideband unit that recovers the baseband signal and all subcarriers present on the satellite signal (including dispersal) from the frequency modulated 70 MHz IF signal. The Demodulator feeds the clamper and subcarrier cards of the various Receiver configurations (described later) as well as the baseband output connector (J10) on the rear panel. A digital automatic frequency control (AFC) loop is also incorporated on the Demodulator card to generate an AFC voltage for electronic control of the Local Oscillator

The 70 MHz IF signal is received from the IF Amplifier via a coaxial jumper cable at connector J1. The signal is fed through a level adjust pad and broadband impedance matching transformer to a pair of integrated circuit differential amplifiers for limiting and amplification. The 70 MHz IF signal is then divided down to 35 MHz and fed simultaneously to a digital demodulator circuit and a digital AFC loop. The output of the Demodulator, comprised of ECL NOR gates, is the recovered baseband signal (plus subcarriers). The baseband signal is low pass filtered and preamplified before it is sent to a de-emphasis network that has a response characteristic inverse to emphasis introduced at the uplink Transmitter producing a flat response. A dc-coupled Baseband Amplifier provides the necessary gain to produce a 1V P-P baseband signal output at rear panel jack J10. Variable resistor R30 located at the front edge of the card sets the baseband signal level while U-link jumper plug W1 provides the means for signal inversion. The baseband signal plus subcarriers and dispersal is distributed through pin 10 of the card-edge connector via the Backplane Interconnect board (to the clamper and subcarrier cards).

① Fig 5-4

The digital AFC circuit sends the IF signal, now at 35 MHz, through a series of counters to a CMOS Phase Comparator, in which it is compared with a crystal-controlled reference signal. The detected phase difference produces an AFC voltage that varies corresponding to the frequency error (nominal -3 to -14 Vdc AFC range). The AFC voltage is sent to the Local Oscillator via pin 4 of the card-edge connector. Two test jacks, one on the front edge of the card and one on the Receiver's rear panel (TP1), permit monitoring of the AFC voltage for test or adjustment purposes. U-link jumper plug, W2, on the card can be used to disable the AFC loop and supply a regulated dc voltage to the LO in place of the AFC voltage. The front panel meter indicates AFC voltage and should read center scale for -8.5 Vdc.

NOTE

The Receiver baseband or video controls should **not** be used for system level control. The baseband output level control, potentiometer R30, must be set for 1V P-P output into a 75 ohm unbalanced load. All other gain adjustments are dependent on this; otherwise Receiver performance may be adversely affected.

VIDEO CLAMPER/SUBCARRIER PROCESSOR (Receiver Configurations A and B). The Video Clamper/Subcarrier Processor is comprised of two separate and distinct circuits on a single card; a Video Clamper Amplifier circuit and a Subcarrier Processor circuit. The Video Clamper Amplifier circuit removes all subcarriers and the dispersion waveform from the baseband signal resulting in a "clean" video signal. This module has an additional notch filter at 4.5 MHz which causes additional ringing and relative chroma delay and reduced frequency response. The Subcarrier Processor circuit converts the program audio subcarrier (at 6.2 or 6.8 MHz) to a 4.5 MHz subcarrier. This audio subcarrier (now at 4.5 MHz) is added to the video signal in the Clamper to produce two composite signal outputs at rear panel connectors J11 and J16. This card provides the Receiver with the capability to drive a microwave system directly without the need for an external audio modulator. When the Receiver is equipped with an inboard Cable Modulator option as well, its capability is expanded so that it can simultaneously feed a cable system and a microwave system directly.

The baseband signal from the Demodulator card is received at pin 10 of the card-edge connector and fed simultaneously to the Video Clamper Amplifier and Subcarrier Processor circuits. The Video Clamper Amplifier circuit functions in a manner similar to the Video Clamper Amplifier card to remove all subcarriers from the baseband signal and provide 50 dB of dispersal rejection (see Video Clamper Amplifier–Configuration C).

In the Subcarrier Processor circuit, the baseband signal is sent to a bandpass filter that is factory tuned to pass the program audio subcarrier (at either 6.2 or 6.8 MHz which must be specified) while attenuating the video and all other subcarriers. The desired audio subcarrier is amplified and applied to a double balanced mixer where it is heterodyned with a crystal-controlled LO signal that is 13.5 MHz above the subcarrier frequency. A bandpass filter following the mixer allows the 13.5 MHz difference signal to pass. This signal is amplifier and fed to a TTL counter where it is divided by a factor of three to produce the 4.5 MHz program audio subcarrier. This division reduces the deviation from 75 kHz to the TV standard 25 kHz. The 4.5 MHz subcarrier output of the counter is split and follows two different paths. In one path, it is fed to the Video Clamper Amplifier where it is added to thevideo-signal androuted through pins 12 and 14 of the card-edge connector to rear panel connectors J11 and J16. Potentiometer R9 sets the video output level; R24 sets the subcarrier level.

The second path for the 4.5 MHz subcarrier is used only when the Cable Modulator option is employed (Receiver Configuration B). Here, the signal is amplified and is routed through pin 4 of the card-edge connector to the Cable Modulator card. In this configuration, the second composite output at rear panel connector J16 (mentioned above) is routed via coaxial jumper cable to the Cable Modulator card input connector J9.

SUBCARRIER DEMODULATOR (Single or Dual). The Subcarrier Demodulator recovers audio signals from the frequency modulated RF subcarriers in the baseband signal. The card is optionally furnished as a single or dual unit operating at factory preset RF subcarrier frequencies supplying balanced 600 ohm audio outputs at rear panel connectors J13 (Audio A) and J24 (Audio B). When a second Subcarrier Demodulator card is installed (not available in Receiver Configuration C), up to two additional audio outputs are supplied at rear panel connectors J14 (Audio A) and J25 (Audio B).

Standard subcarrier frequencies are 6.2 MHz, 6.8 MHz, and 7.5 MHz with other frequencies available on special order.

The baseband signal from the Demodulator card is received at pin 10 of the card-edge connector. When the card is equipped with two Subcarrier Demodulator circuits, the baseband signal simultaneously feeds both circuits. The first operation to be performed in the Subcarrier Demodulator circuit is to apply the baseband signal to a bandpass filter tuned to allow the desired RF subcarrier frequency to pass while attenuating the video and other unwanted subcarriers. The selected subcarrier is amplified to compensate for losses incurred in the filter and applied to an integrated circuit FM quadrature detector. Here, the audio signal is recovered from the frequency modulated subcarrier. The output of the FM detector is sent to a 75 microsecond de-emphasis network to restore the emphasized audio signal to its original form. An integrated circuit audio amplifier makes up the final stage of the audio circuit. The balanced audio signal is fed through pins 1 and 2 (pins 12 and 14) to the output connector J13 (J24) on the rear panel. Variable resistor R114 (R214) located at the front edge of the card sets the signal level at +9 dBm into a balanced 600 ohms load using a 1 kHz test tone at 75 kHz peak deviation.

VIDEO CLAMPER (Receiver Configuration C). The Video Clamper card removes all subcarriers as well as the dispersion waveform from the baseband signal and amplifies the video signal to produce two "clean" video signal outputs at rear panel connectors J11 and J16.

The baseband signal from the Demodulator card is received at pin 10 of the card-edge connector. This signal is fed through a level adjusting pad to a video Low Pass Filter for

removal of subcarriers. An equalizer stage corrects the video signal for group delay and feeds it to a dc coupled video amplifier and clamper circuit. The clamper is a feedback type that reduces the dispersal waveform by 50 dB with respect to the luminance signal. For this purpose, a sample of the video signal is taken from the output of the video amplifier and fed through an active low pass filter to remove high frequency components. The filtered signal is sent to an inverting amplifier that feeds a sync stripper circuit. The sync stripper produces a reconstructed sync pulse that activates a sampling switch. A sample of the voltage occurring during the backporch (of the video signal) is taken and compared to 0V. If the sample is not zero, an error signal is generated and summed with the video signal to cancel the disturbance.

The clamped video signal is fed through pins 12 and 14 of the card-edge connector to the video signal output connectors J11 and J16 on the rear panel. Variable resistor R6 located at the front edge of the card sets the signal level at 1V P-P.

CABLE MODULATOR OPTION (Receiver Configuration B). The optional inboard Cable Modulator is comprised of a Modulator card and an RF Converter card. These cards combine to produce an RF output containing video and program audio carriers at standard CCIR cable frequencies which must be specified for each application. Satellite Receivers that are equipped with this option have the capability of feeding a cable system directly.

CABLE MODULATOR OPTION. The Theory of Operation of the Cable Modulator is divided into two parts: that of the IF Modulator and that of the RF Converter.

IF MODULATOR. This module takes, as input, a combined video baseband and 4.5 MHz audio subcarrier input (composite video) and a separate 4.5 MHz audio subcarrier input to produce an IF television signal in compliance with CCIR System M specifications.

The composite video signal (pin 14) is precorrected for phase so that the Cable Modulator option meets FCC specifications for color broadcasting. The video modulation level is set by potentiometer R2. A unity-gain dc coupled amplifier buffers the input to the Modulator.

The audio subcarrier input (pin 4) is preamplified by a push-pull amplifier and applied to the Modulator through subcarrier gain control R59. This input does not contain any video information.

The IF carrier input to the Modulator is a leveled 45.75 MHz sine wave. The signal originates in carrier oscillator U4. The TTL output of U4 feeds buffer Q4 and is low pass filtered before its becoming an input to the Modulator.

The Modulator, a Fairchild μ A796, accepts the three inputs and produces a double sideband (DSB) with carrier IF output. The composite video and audio subcarrier inputs are combined 180° out-of-phase due to the differential inputs of the Modulator. Differential outputs of the Modulator are combined in transformer T1.

The DSB IF carrier level is set with the IF carrier level adjustment R23, part of a 75 ohm variable attenuator. Feedback and matched input are characteristics of linear amplifier Q3. These permit linear operation at high signal levels and a 75 ohm output impedance with which to drive the vestigial sideband (VSB) filter.

The VSB filter is composed of three parts: a low pass filter (LPF), an isolation pad, and a high pass filter (HPF). Both the LPF and HPF are tuned by transmission zeros. The pad provides isolation between filters so that any non 75 ohm impedance from one does not detune the other. An equalizer at the filter output provides both phase and amplitude correction to the final VSB spectrum. The IF output has video carrier at 45.75 MHz and audio subcarrier at 41.25 MHz (4.5 MHz lower). The output level is +37 dBmV (-12 dBm) ±1.5 dB. The audio subcarrier level is 15 dB below the video carrier level.

RF CONVERTER. The RF Converter translates the IF Modulator output to any of the CCIR System "M" Channels listed in Table 1-1. This translation includes the appropriate sideband inversion so that the audio subcarrier is 4.5 MHz above the video carrier.

The IF signal is applied, through a 6 dB pad, to the mixer, a Mini Circuit Lab's SRA-1H. This pad insures wideband impedance matches to both the mixer and the circuit driving it (the IF Modulator). The mixer is a high level (+14 dBm local oscillator (LO) input), double-balanced type which minimizes third order products.

The LO signal originates in a two stage crystal oscillator. The frequency of oscillation is varied by crystal selection and collector peaking (parallel-tuned LC circuit) in the first stage. A doubler, Q7, is used for all frequencies above Channel B. Doubler output is filtered by the parallel combination of L19 and C47 and series "Tee" network C48, C49, and L20.

The LO frequency, whether doubled or not, is passed through a coupled resonator filter in which the rejection above the center frequency falls off faster than the rejection below the center frequency.

The LO signal is coupled through a 75 ohm attenuator (level adjust R52) to the LO Power Amplifier, Q6. A series-tuned shunt trap (L25-C59) at the output of the amplifier attenuates any feedthrough of the crystal frequency. The LO level is adjusted, using the attenuator, for optimum performance of the mixer.

The output of the mixer goes to a preamplifier with an input pad. The pad insures good wideband impedance matches for both the mixer and the amplifier.

From the preamplifier, the signal, now at the RF frequency, goes through a series of two elliptic filters and an attenuator. The low pass and high pass filters, in combination, form a bandpass filter. This selects the lower sideband output of the mixer and attenuates any out-of-band signals. The degree of the filters varies with frequency as the percentage bandwidth changes. Channels 2 through 6 and the midband channels generally have filters of degree 5 while higher frequencies have filters of degree 7. The attenuator is used in setting the output level of the module.

Table 1-1. TV Channel Data

BAND	CHANNEL	FREQUENCY RANGE (MHz)	CARRIER FREQUENCY (MHz)		
			VIDEO	COLOR	SOUND
Sub VHF	T-7	5.75 - 11.75	7.0	10.58	11.5
	T-8	11.75 - 17.75	13.0	16.58	17.5
	T-9	17.75 - 23.75	19.0	22.58	23.5
	T-10	23.75 - 29.75	25.0	28.58	29.5
	T-11	29.75 - 35.75	31.0	34.58	35.5
	T-12	35.75 - 41.75	37.0	40.58	41.5
	T-13	41.75 - 47.75	43.0	46.58	47.5
Low VHF	2	54 - 60	55.25	58.83	59.75
	3	60 - 66	61.25	64.83	65.75
	4	66 - 72	67.25	70.83	71.75
	5	76 - 82	77.25	80.83	81.75
	6	82 - 88	83.25	86.83	87.75
FM	FM	88 - 108			
Mid	A1	120 - 126	121.25	124.83	125.75
	B	126 - 132	127.25	130.83	131.75
	C	132 - 138	133.25	136.83	137.75
	D	138 - 144	139.25	142.83	143.75
	E	144 - 150	145.25	148.83	149.75
	F	150 - 156	151.25	154.83	155.75
	G	156 - 162	157.25	160.83	161.75
	H	162 - 168	163.25	166.83	167.75
	I	168 - 174	169.25	172.83	173.75
High	7	174 - 180	175.25	178.83	179.75
	8	180 - 186	181.25	184.83	185.75
	9	186 - 192	187.25	190.83	191.75
	10	192 - 198	193.25	196.83	197.75
	11	198 - 204	199.25	202.83	203.75
	12	204 - 210	204.25	208.83	209.75
	13	210 - 216	211.25	214.83	215.75
Super	J	216 - 222	217.25	220.83	221.75
	K	222 - 228	223.25	226.83	227.75
	L	228 - 234	229.25	232.83	233.75
	M	234 - 240	235.25	238.83	239.75
	N	240 - 246	241.25	244.83	245.75
	O	246 - 252	247.25	250.83	251.75
	P	252 - 258	253.25	256.83	257.75
	Q	258 - 264	259.25	262.83	263.75
	R	264 - 270	265.25	268.83	269.75
	S	270 - 276	271.25	274.83	275.75
	T	276 - 282	277.25	280.83	281.75
	U	282 - 288	283.25	286.83	287.75
	V	288 - 294	289.25	292.83	293.75
	W	294 - 300	295.25	298.83	299.75

After selection of the lower sideband, the signal is amplified by two stage (Q2 and Q3) output amplifier. Each stage is in a common emitter configuration with both emitter degeneration and feedback from the output to the input. Located at the output of the first stage is a series-tuned shunt trap (L26-C66) resonant at the crystal oscillator frequency. It is only used on channels 2 through 6, A through I, 7 through 13, and J through W.

After amplification, the signal is again low pass filtered by either a fifth or seventh degree elliptic filter. This filter removes harmonics of the output signal as well as providing more attenuation of the image frequency. Another series-tuned shunt trap (L27-C67), at the crystal oscillation frequency, is used at the output of the RF Converter (Pin 12). The output level is +53 dBmV (+4 dBm) ±1 dB. The resulting output signal is routed to rear panel connector J26 (Type F) where it is available for connection to the cable system.

The IF Modulator and RF Converter use identical voltage regulator circuits. Three terminal regulators provide, from the unregulated positive (Pin 5) and negative (Pin 8) voltage inputs, regulated +12Vdc and -12 Vdc outputs.

POWER SUPPLY. The Power Supply operates from a 115/230 Vac primary power source to produce the +15V and -18V regulated voltages and a pair of unregulated voltages require to power the Receiver subsystems. The Power Supply is fused, using a 3A fuse for 115 Vac operation and a 1.5A fuse for 230 Vac operation. The primary windings of the transformer are connected in parallel for 115 Vac operation or in series for 230 Vac operation. The transformer has two secondary windings. Each is connected to a bridge rectifier. The dc voltages are filtered and applied to integrated circuit voltage to develop the +15V and -18V regulated voltages. A voltage is taken from each bridge, one positive and the other negative. These voltages are unregulated and will vary with the line voltages. The positive unregulated voltage (20 to 26V at 0.2A) is fused and routed to rear panel connector J18 to power auxiliary equipment.

24 CHANNEL SPACED AT ½ 20 mHz.

SPECIFICATIONS

GENERAL

Type	superheterodyne, dual conversion
Radio Capacity	525 line video plus audio subcarriers
Frequency Range	3.7 to 4.2 GH*
Noise Figure	15 dB nominal
Threshold	3 dB extension when compared 30 MHz BW -i.e., 7 dB threshold
Local Oscillator Stability	AFC
Image Rejection	greater than 40 dB
RF	
Return Loss	20 dB
Input Level	-30 dBm maximum
IF Bandwidth (70 MHz)	30 MHz standard
Modulation	FM
Video	
Outputs	one baseband output; two filtered video outputs or composite** outputs
Level	1V P-P adjustable to 1.5V P-P***
Impedance	75 ohms
Return Loss	26 dB
Audio	
Output	+9 dBm maximum @1 kHz TT w/75 kHz peak deviation
Impedance	600 ohms balanced
Frequency Response	
30 Hz to 15 kHz	±0.5 dB

VIDEO PERFORMANCE (w/Threshold Extension)

Signal-to-Noise (CCIR Weighted @ 16 dB C/N, 10.75 MHz peak deviation)	53 dB minimum
Signal-to-Hum (P-P to RMS)	58 dB
Clamping (Dispersion Waveform)	50 dB minimum rejection
Differential (10 to 90% APL)	
Phase	±1°
Gain	±2%
Line Time Distortion	1 IRE unit maximum
Field Squarewave Tilt	2 IRE units maximum
Short Time Distortion	3 IRE units maximum
Frequency Response	
Video (Filtered) Output	
10 kHz to 4.2 MHz	+0.5, -3 dB maximum
Baseband Output	
10 kHz to 4.2 MHz	+0.5, -1 dB maximum
4.2 MHz to 8 MHz	+0.5, -3 dB maximum

COMPOSITE OUTPUT (Meets Video Performance Specified Except as Follows)

Video	
Short Time Distortion	5 IRE units ringing
Frequency Response	4.5 MHz Notch, -3 dB @4.2 MHz
Audio	no measurable degradation

PRIMARY POWER

Source	105 to 125 Vac (47 to 63 Hz; 210 to 250 Vac optional
Consumption	
Basic	less than 45
With All Options	less than 75

ENVIRONMENTAL

Temperature Range	
Full Specification	+10 to +40°C
Operational	0 to +50°C
Humidity	90% (0 to +50°C)
Elevation	
Operational	15,000 feet (4,500m)
Storage	50,000 feet (15,000m)

MECHANICAL

Size	19″ (w) x 18″ (d) x 5.25″ (h) (48.3 x 45.7 x 13.3 cm)
Weight	less than 25 lbs. (11.4 kg)
Connectors	
Audio	Terminal Strip
RF Input	Type N Coax
Cable Modulator Output	Type F Female
Video Baseband and Filtered Outputs	Type BNC Coax
Prime Power	AC Power Cord (w/3-prong plug)
Auxiliary Power Output	4 Pin Molex Female, 20 to 26 Vdc (positive unregulated), 200 mA

CABLE MODULATOR (Optional)

Modulation Flatness	
30 Hz to 4 MHz	±0.5 dB
4 MHz to 4.2 MHz	+1 dB, -2 dB
Differential (10-90% APL)****	
Phase	±1°
Gain	0.5 dB maximum
AC Hum and Noise****	60 dB below
Lower Sideband Vestigial	meet FCC 73.687
Frequency Stability	±0.005% maximum
RF Output	
Level	+53 dBmV ± 1 dB typical; +50 dBmv minimum
Impedance	75 ohms unbalanced
Return Loss	16 dB minimum
Frequency	any standard CCIR system "M" channel, T7 through T10 and 2 through W
Spurious Signals and Inter-modulation Products	at least 60 dB below visual carrier

All specifications are subject to change without notice.
*Local Oscillator field adjustable through front panel.
**Composite output is filtered video w/4.5 MHz aural subcarrier.
***Not with Cable Modulator.
****87.5% modulation.

SECTION 2
INSTALLATION

UNPACKING AND HANDLING

UNPACKING. Each Receiver is shipped with all equipment assembled, wired, factory-system tested, and then packaged in appropriate shipping containers.

Ensure that all parts and accessories are removed from the container and packing material before they are discarded.

MECHANICAL INSPECTION. Inspect the front and rear of the equipment for shipping damage. Make sure that all modules are firmly seated, the equipment is clean, and no wires, cables or connectors are broken, damaged or loose.

NOTE

DO NOT operate switches or controls other than Frequency Selection; as the equipment has been factory adjusted for proper operation prior to shipment and may need only minor adjustment before being placed in service.

DAMAGE IN SHIPMENT. Should any damage be discovered after unpacking the system, immediately file a claim with the carrier. A full report of the damage shall be made and a copy forwarded to Microwave Associates Communications Company. The company will then advise what disposition is to be made of the equipment.

PRECAUTIONS

Adherence to the initial installation precautions outlined in Table 2-1 will help prevent problems arising during initial installation and future maintenance of the VR-3X Satellite Receiver.

Table 2-1. Installation Precautions

PRECAUTION	REQUIREMENT
Ensure easy access to rack wiring.	Allow a minimum of 18 inches clearance behind the equipment rack(s).
Facilitate servicing and maintenance.	Allow a minimum of 36 inches clearance in front of equipment rack(s).
Avoid direct heating or air conditioning.	If unavoidable, use deflector plates.
AC power source outlets.	Locate equipment near sufficient outlets to provide power for test equipment and power tools.
Rack support.	Make certain rack supports are sufficiently rigid to support rack(s).
Building leakage.	Beware of dripping water onto equipment from leaky roofs, waveguide roof entries, and cold water pipe condensations.

INSTALLATION PRACTICES

RACK (If supplied). After removing the top and sides of the shipping container and removing the packing material and auxiliary equipment, free the rack from the pallet by removing the bolts and nuts securing it in place. Proceed as follows:

1. Remove the rack from its crate by lifting it off the mounting bolts and place it near its final mounting locations. After the rack has been raised to a vertical position, remove the shipping support brackets that held it in the crate from the rack side rails.

2. A template may be used for marking the floor locations for drilling anchor holes. However, if the rack is available when these holes are drilled, it is recommended that the rack base itself be used as a template, and then moving it aside to drill the holes (Figures 2-1 and 2-2).

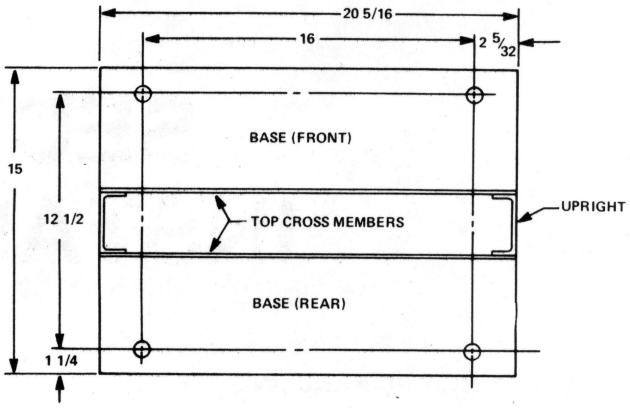
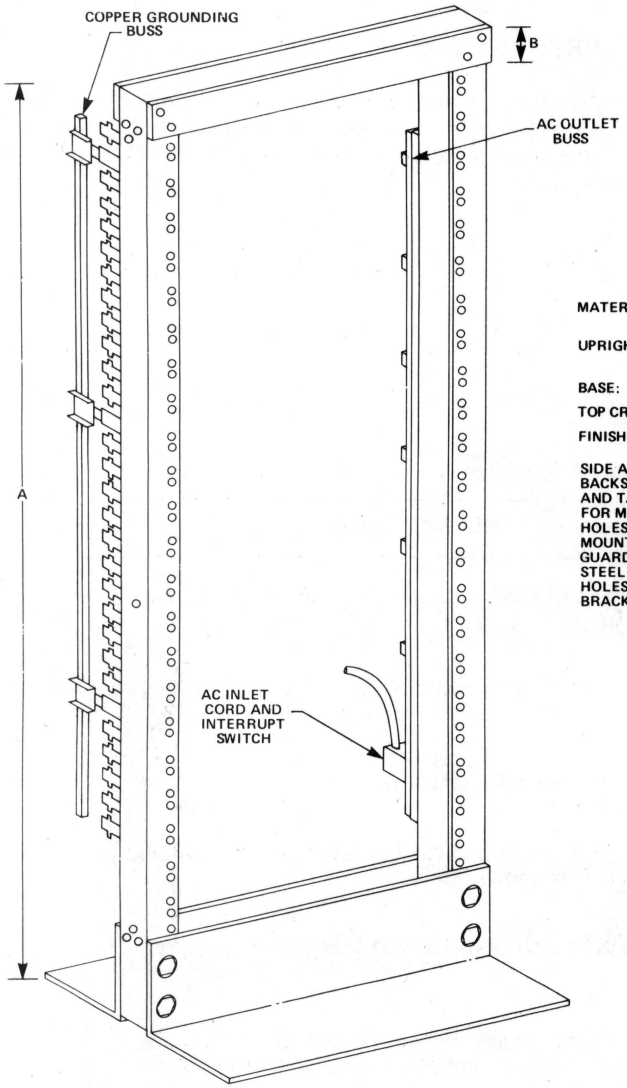


Figure 2-1. Rack Hole Pattern



SPECIFICATIONS

MATERIAL: 6061-T6 ALUMINUM EXTRUSION

UPRIGHTS: 76.2mm X 34.925mm CHANNEL 6.35mm THICK

BASE: 100.016mm X 152.4 mm ANGLE 9.5mm THICK

TOP CROSS MEMBER: 25.4mm X 9.5mm BAR

FINISH: TELEPHONE GREY BAKED ENAMEL.

SIDE AND BACK DRILLING:
BACKS OF UPRIGHTS ARE DRILLED AND TAPPED AT 304.8mm OR 355.6mm INTERVALS FOR MOUNTING CABLE BRACKETS. SIDE HOLES ARE FOR BOLTING RACKS TOGETHER, MOUNTING SHIPPING BRACKETS AND GUARD RAILS, OR FOR CRANE HOISTING. STEEL NUTS ARE INSERTED IN THOSE HOLES USED TO ATTACH SHIPPING BRACKETS.

HEIGHT A		EQUIPMENT MOUNTING SPACES	APPROXIMATE WIDTH 48.3cm (NOTE)	HEIGHT B	
METRIC	U.S.			METRIC	U.S.
2133.60mm	7FT	44	35	34.925mm	1-3/8
2285.00mm	7FT 6IN	47	36	34.925mm	1-3/8
2438.40mm	8FT	51	37	34.925mm	1-3/8
2641.60mm	8FT 8IN	55	38	34.925mm	1-3/8
2743.20mm	9FT	57	39	66.675mm	2-5/8
2971.80mm	9FT 6IN	61	40	41.275mm	1-5/8

NOTE
WEIGHTS SPECIFIED ARE FOR UNLOADED RACK

Figure 2-2. Rack Outline Drawing

3. Hole size is determined by the type of anchor to be used. On concrete floors, the following hardware (or equivalent) should be used.

a. Bolts–3/8 - 16 x 2″.
b. Washers–3/8″ lock and flat (1 each per bolt).
c. Anchors–3/8 - 16 x 2″ Calking Anchors:
"Diamond" Type 03060;
"Star" Type 4025-00000.

NOTE

These anchors require a 3/4″ hole.

On wood floors, it is recommended that 3/8 x 1-1/2 inch lag bolts with lock and flat washer be used.

4. The rack should be secured to adjacent racks and to the existing superstructure as applicable. The attachment to the superstructure will normally be using standard telephone practices, using J-bolts to the top rack braces.

5. If there is not an existing superstructure, the top of the rack should be braced to the ceiling or walls.

GROUNDING. The rack must be grounded. Connect the rack to the station ground using #6 copper wire. The ground connection is made to the rack grounding buss (Figure 2-2).

UNIT MOUNTING. The VR-3X Satellite Receiver is designed for mounting in a standard 19-inch EIA equipment rack. The bezel of the Receiver has mounting flanges with standard open-ended slots (as in a 19 x 5-1/4″ rack panel) to secure the unit to the rack (Figure 2-3).

Protect the protruding elements on the rear panel during installation and orientation. Allow unobstructed access to the rear panel. Refer to Figure 2-4 and connect the terminals and signal cables, as necessary, for video, audio, baseband outputs, and RF input(s).

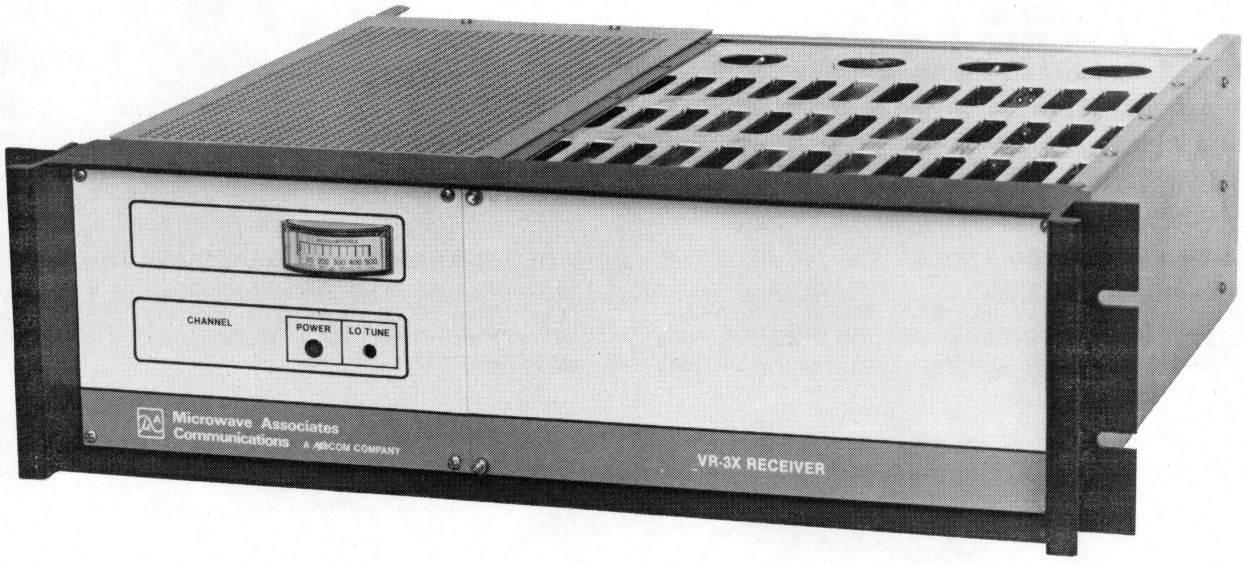


Figure 2-3. VR-3X Satellite Receiver – Front View

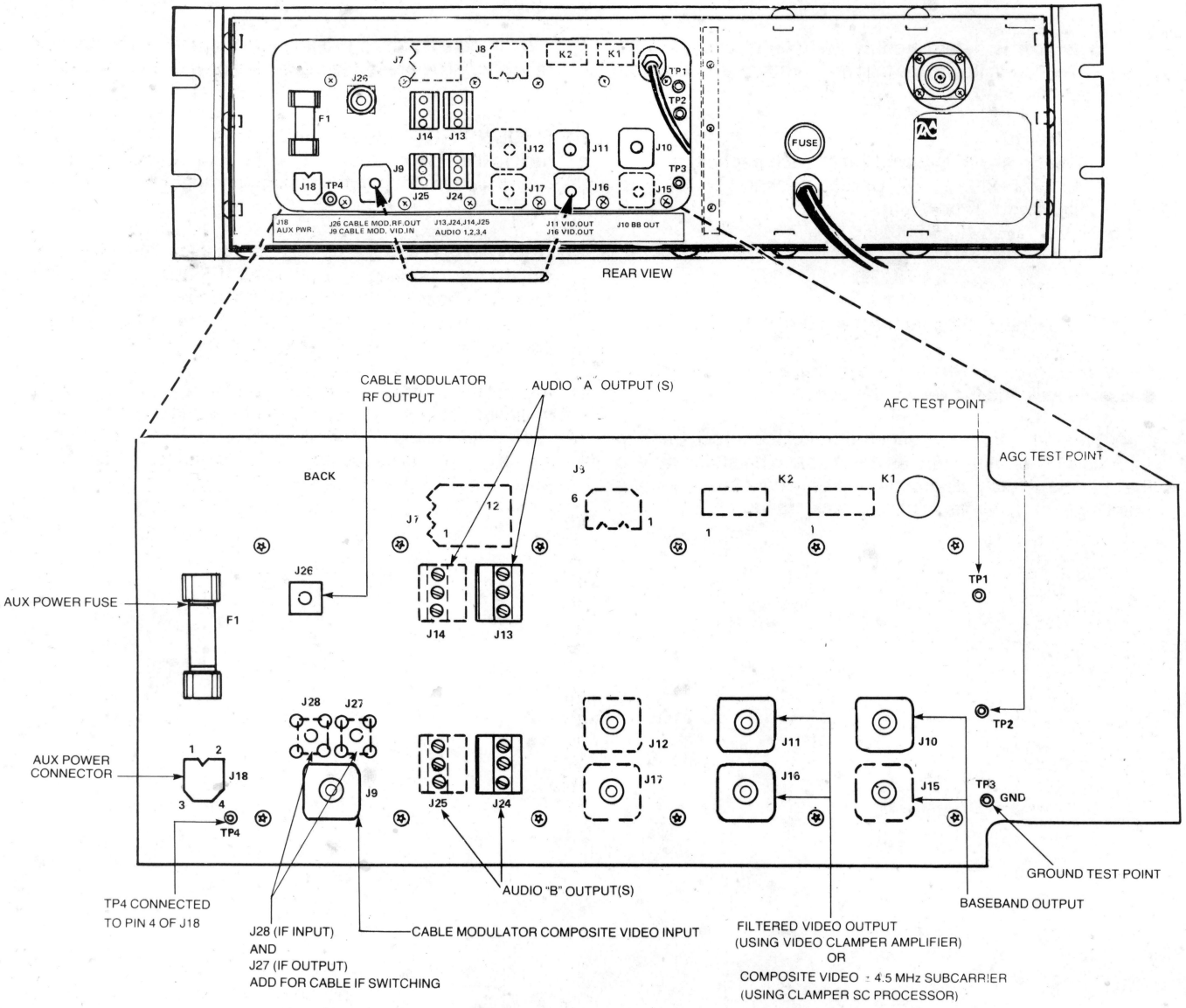


Figure 2-4. VR-3X Satellite Receiver – Rear View

ANTENNA/LNA CONNECTIONS. The RF INPUT connector (Type N) located at the rear of the chasis provides the means for connection of the Receiver to the antenna/LNA. The antenna connections are made with a short section of a flexible cable to the station antenna runs. The flexible cable will prevent movement, tension, and vibration from affecting equipment. The feedline should be connected to a antenna/LNA of the proper polarity for the desired channel (Table 2-2). The incorrect feedline can give the appearance of the Receiver's being 20 MHz off frequency.

NOTE

The input feed line should be strain relieved at the rack or other appropriate locations. The input connection should not bear the full weight of the input feed line.

VIDEO AND BASEBAND SIGNAL OUTPUTS. Type BNC coaxial connectors are used for video and baseband signal output connections. Note that some connector functions vary with the different Receiver configurations that are available (Table 2-2).

Table 2-2. Satellite Channel Frequencies

FREQUENCY (MHz)	24 TRANSPONDER SATELLITE CHANNELS	POLARIZATION	12 TRANSPONDER SATELLITE CHANNELS	POLARIZATION
3720	1	V	1	H
3740	2	H		
UNITED VIDEO → 3760	3	V	2	H
3780	4	H		
3800	5	V	3	H
SOUTHERN SATELLITE → 3820	6	H		
3840	7	V	4	H
3860	8	H		
3880	9	V	5	H
3900	10	H		
3920	11	V	6	H
3940	12	H		
3960	13	V	7	H
3980	14	H		
4000	15	V	8	H
4020	16	H		
4040	17	V	9	H
4060	18	H		
4080	19	V	10	H
4100	20	H		
4120	21	V	11	H
4140	22	H		
4160	23	V	12	H
4180	24	H		

Table 2-3. Rear Panel Connectors and Test Points

REF DES	DESCRIPTION	CONFIGURATION A (Clamper/SC Processor w/o Cable Modulator)	CONFIGURATION B (Clamper/SC Processor w/Cable Modulator)	CONFIGURATION C (Video Clamper)
–	Type N (F) connector	RF input signal connection from antenna/LNA.	Same	Same
–	AC power cord with 3-prong connector	115 Vac line power connection (Note 1)	Same	Same
–	Fuse, 115 Vac: 3A; 230 Vac: 1.5A	Overload protection for line power and power supply	Same	Same
J10	Type BNC (F) connectors	Baseband output (contains all subcarriers on satellite signal including dispersal).	Same	Same
J11	Type BNC (F) connectors	Composite output (video plus 4.5 MHz subcarrier).	Same	Filtered video output.
J16	Type BNC (F) connectors	Composite output (video plus 4.5 MHz subcarrier).	Connect to J9 (Cable Modulator input) using coax jumper cable.	Filtered video output.
J13	3-pin barrier strip	Optional Audio A output.	Same	Same
J24	3-pin barrier strip	Optional Audio B output.	Same	Same
J14	3-pin barrier strip	Optional Audio A output.	Not Used	Optional Audio A output.
J25	3-pin barrier strip	Optional Audio B output.	Not Used	Optional Audio B output.
J9	Type BNC (F)	Not Used	Connect to J16 (Clamper/SC Processor output) using coaxial jumper cable.	Not Used
J26	Type F (F)	Not Used	Cable Modulator/Frequency Converter RF output.	Not Used
J18	4-pin receptacle	Auxiliary power output (unregulated + 20 to + 26 Vdc, 0.2A).	Same	Same
F1	Fuse (0.2A)	Overload protection for power supply.	Same	Same
TP1	Test Jack	AFC monitor test point.	Same	Same
TP2	Test Jack	AGC monitor test point.	Same	Same
TP3	Test Jack	Ground.	Same	Same
TP4	Test Jack	Access point for connection to auxiliary power receptacle.	Same	Same

NOTE

AC power cord for units operating from 230 Vac power source will have three flying leads for line power connection in place of 3-prong connector.

AUDIO SIGNAL OUTPUTS (Optional). Three-pin barrier strips are provided for audio signal output connections (600 ohms balanced)

IF SWITCHING (Optional). The VR-3X Receiver can be modified for Cable IF Switching as follows:

1. Carefully remove the plug-in modules (IF Amplifier, Demodulator, etc.) and set them aside.

2. Referring to Figure 2-5, cut the etch on the Backplane printed wiring board at the point indicated.

3. Add jacks J27 and J28 as shown by soldering them in place from the inside of the Receiver. The necessary mounting holes are provided and are plated through. J27 and J28 are PC mounting F connectors, MAC Part No. 189396-48. J27 is the IF Modulator output and J28 is the RF Converter IF input.

POWER REQUIREMENTS

Primary power is optionally 115 or 230 Vac and must be specified for each application. A fully equipped Receiver requires less than 60W.

The line power for the equipment enters the Receiver through the ac power cord. The ac line power operates the Power Supply module. A fuse located at the rear of the chassis protects the Power Supply and input power source.

An additional fuse located on the backplane protects the auxiliary power source.

The Receiver will be activated when the unit is plugged into the ac line. Due to the continuous nature of the Receiver operation, an ON-OFF switch is not included in the Receiver.

CAUTION

The main power should be turned OFF and remain OFF until all power circuits are connected and until the initial turn-on of the equipment.

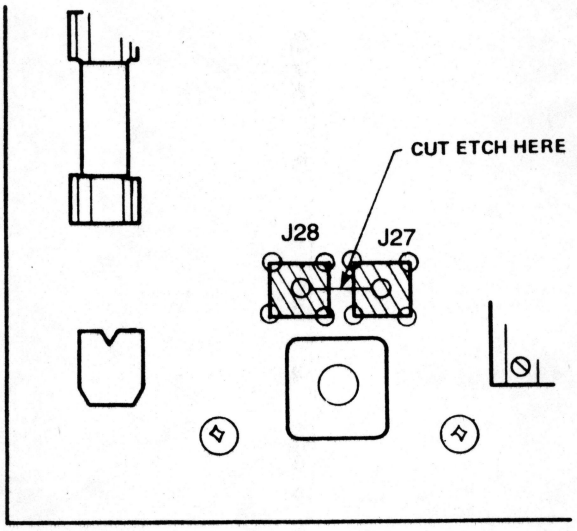


Figure 2-5. IF Switching Installation

SECTION 3
OPERATING INSTRUCTIONS

CONTROLS AND INDICATORS

The front panel controls and indicators for the VR-3X Satellite Receiver are shown in Figure 3-1 and listed in Table 3-1.

Internal controls are shown in Figure 3-2 and listed in Table 3-2. Removal of the Receiver front panel provides access to internal controls listed in Table 3-2.

Table 3-1. Front Panel Controls and Indicators

CONTROL OR INDICATOR	LEGEND	FUNCTION
Panel Meter (0 - 500 μ A)		Monitors AFC voltage.
LED (Red)	POWER	Indicates power ON when lit.
Screwdriver Adjustment	LO TUNE	Manually tunes Receiver across entire band of 3.700 to 4.200 GHz. Automatic frequency control locks Receiver to signal of selected channel.

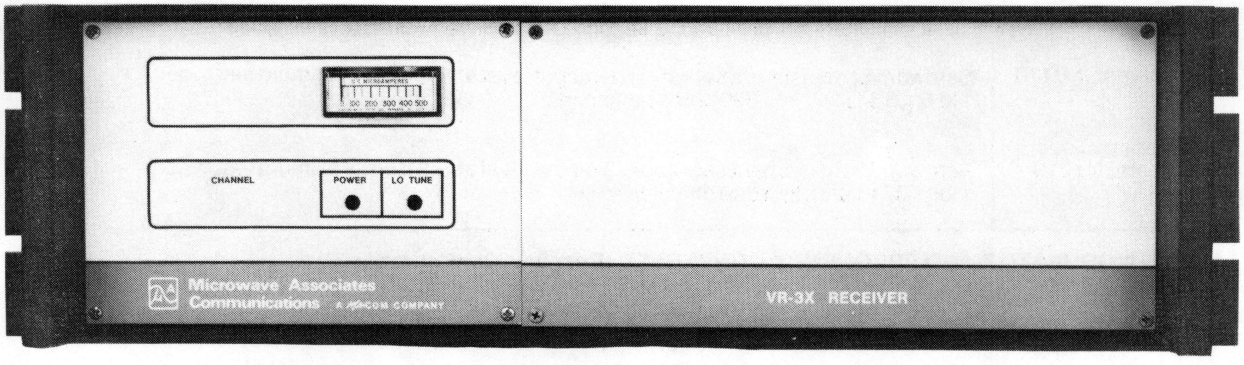
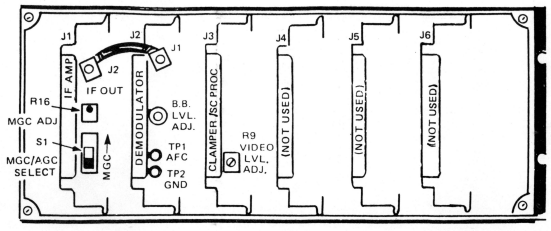


Figure 3-1. Front Panel Controls and Indicators

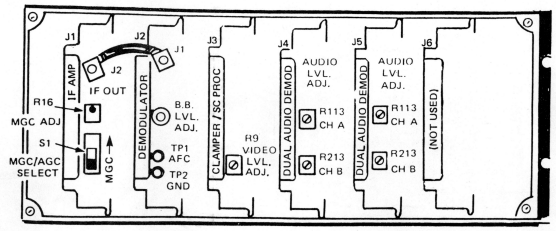
Table 3-2. Internal Controls

CONTROL	FUNCTION
IF MODULE	
Slide Switch, S1	Selects automatic or manual gain control (AGC or MGC) mode. Set switch in down position for normal Receiver operation; up position (MGC) for test or adjustment purposes.
Potentiometer R16	Screwdriver adjustment sets manual gain control. Slide switch S1 must be in up position (MGC) to perform this adjustment.
Connector J2	IF output signal connection.
DEMODULATOR BOARD	
Potentiometer, R30	Screwdriver adjustment sets Receiver baseband output level at 1 V pp, 75 ohms unbalanced (J10).
Test Point TP1	AFC monitor test point.
Test Point TP2	Test meter grounding point.
Connector J1	IF input signal connection.
VIDEO CLAMPER/SC PROCESSOR (Receiver Configuration A and B)	
Potentiometer R9	Screwdriver adjustment sets video portion of composite output level at 1 V P-P (J11 and J16).
VIDEO CLAMPER (Receiver Configuration C Only)	
Potentiometer R6	Screwdriver adjustment sets filtered video output level at 1 V P-P, 75 ohms unbalanced (J11 and J16).
DUAL SC DEMODULATOR (Optional)	
When four Audio Channels are used, a second Dual SC Demodulator is installed.	
Potentiometer R113	Screwdriver adjustment sets audio A output level at + 9 dBm maximum test tone 1 kHz [J13 (J14)] into 600 ohms balanced.
Potentiometer 213	Screwdriver adjustment sets audio B output level at + 9 dBm maximum test tone 1 kHz [J24 (J25)] into 600 ohms balanced.
CABLE MODULATOR AND FREQUENCY CONVERTER (Receiver Configuration B)	
No user adjustable controls.	



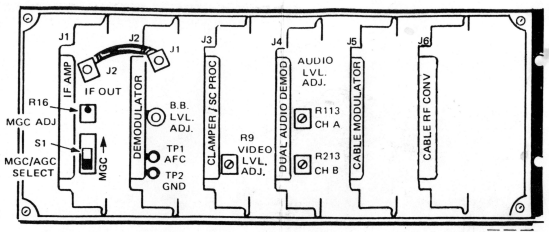
BASIC CONFIGURATION

OUTPUTS: Baseband at J10.
Composite Video at J11 and J16.



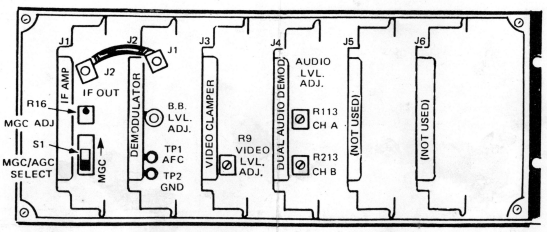
CONFIGURATION A

OUTPUTS: Baseband at J10.
Composite Video at J11 and J16.
Dual audio Demodulator outputs at J13 and J24 (Note 1).
Dual Audio Demodulator outputs at J14 and J25 (Note 2).



CONFIGURATION B

OUTPUTS: Baseband at J10.
Composite video at J11.
Composite video output from J16 to J9.
Composite video input of Cable Modulator via BNC to BNC cable.
Dual Audio Demodulator output (Note 1) at J13 and J24.
Cable Modulator output at J26.



CONFIGURATION C

OUTPUTS: Baseband at J10.
Video outputs at J11 and J16.
Dual Audio Demodulator outputs at J13 and J24 (Note 1).

Note 1 - If single Audio Demodualtor is used, output is at J13.

Note 2 - If single Audio Demodualtor is used, output is at J14.

Figure 3-2. Internal Controls

INITIAL TURN-ON PROCEDURE

CAUTION

Before applying power to the unit, check that all circuit cards are properly seated.

***DO NOT** insert or remove circuit cards while power is applied to the unit.*

Procedure:

Step 1. Verify that primary power voltage is correct and available at the interface.

Step 2. Connect the ac power plug to the prime power source and observe that the POWER indicator lamp lights.

Step 3. Connect a picture monitor to one of the Receiver's video or composite outputs (J11 or J16). The baseband output (J10) may be used, but the dispersal waveform as well as all subcarriers on the signal will be present.

NOTE

The VR-3X is factory tuned to channel 6 prior to shipment unless other frequency is specified at time of order.

Step 4. Using adjustment tool, turn the LO TUNE adjustment control thereby varying the LO frequency (CCW to increase; CW to decrease). The AFC circuit will lock the Receiver to a particular channel until the AFC capture range is exceeded (approximately 10 MHz) and it moves into the next channel where AFC again takes over. Continue this sequence channel by channel while observing the picture monitor until the desired channel is reached as evidence by the program content.

CAUTION

As the limits are approached at either end of the tuning range (i.e., Channel 1 or 24), exercise care when turning the LO TUNE control so as not to damage the tuning mechanism.

Step 5. While monitoring the AFC voltage on the front panel meter, vary the LO tune adjustment until the reading is midscale (250 μA). There is a slight delay between LO tuning and final AFC meter reading. The VR-3X is now locked on frequency. The meter reads center scale when the receiver is in the center of its AFC Locking Range. This is analogous to the tuning of an FM stereo receiver with a zero-center scale reading for best reception and locking to the desired frequency.

NOTE

If a picture is not present, especially in a new installation, the antenna is probably not properly pointed at the satellite; check published data that satellite is not on scheduled outage time. Also verify that the AGC/MGC switch on the IF Amplifier (Figure 3-2) is in the AGC down position.

ADJUSTMENTS

The Receiver is factory aligned, using sophisticated test equipment not usually available in the field. It does **not** need adjustment. The possible exceptions are manual gain control (MGC) and signal output levels. *It is not recommended that any adjustable components be altered.*

CAUTION

*If the Cable Modulator is used, the baseband and video controls on the Receiver **shall not** be used for system level controls. The Cable Modulator operation can be adversely affected if the baseband and/or video are set for other than 1V P-P into 75 ohms.*

SECTION 4
MAINTENANCE AND TROUBLESHOOTING

SCOPE

This section contains the maintenance and troubleshooting procedures.

Maintenance consists of monthly procedures adopted to prevent minor problems from developing into major breakdowns. Initiate and carry out a monthly maintenance schedule to check system operation and to avoid malfunctions. This ensures optimum system performance.

Troubleshooting is initiated when a fault or impairment to normal operation is noted. Troubleshooting procedures will isolate the fault to a subsystem or module. Repair, replacement or adjustment of the subsystem or module will correct the fault to restore normal operation.

MAINTENANCE

Preventive maintenance on the VR-3X Satellite Receiver should be carried out on a monthly basis. To ensure optimum performance, selected signals are measured and the measurements recorded in the maintenance log. Minor adjustments may be required to maintain peak performance. Refer to Figures 3-2, 4-1, 4-2, and the functional block diagrams (located at the end of this section) for locations of measurement points and adjustments. Table 4-1. lists the required test equipment for maintenance and troubleshooting.

Table 4-1. Required Test Equipment

TEST EQUIPMENT	MODEL/PN
Service Kit	MAC PN 1809005
70 MHz Field Strength Meter	Jerrold 727
Voltmeter	Tex Scan VSM 2 DVM
Oscilloscope (10 MHz Min.)	Tektronix 465
Waveform Monitor	Tektronix 1480C

NOTE

The potentiometers accessed behind the front panel are the only adjustments recommended by Microwave Associates Communications. All other components are factory set and should not be adjusted unless specified in this manual.

In some instances, adjustment of one stage will necessitate repeated measurements and adjustments of other stages.

Each entry into the maintenance log should be compared to the previous entries to determine if any irregularity or signal degradation has occurred. If irregularities exist that cannot be remedied with normal maintenance adjustments, refer to the troubleshooting section of this manual.

MAINTENANCE LOG. A sample maintenance log is shown in Figure 4-3. A blank log sheet is provided at the end of this section.

MAINTENANCE CHECKS. Monthly preventive maintenance checks should include visual inspection, any cleaning/dusting necessary, and tightening of all cable connections. Additionally, the following measurements and, if necessary adjustments are required. All measurements should be recorded in the maintenance log for future reference.

NOTE

All measurements should be made for each channel in use.

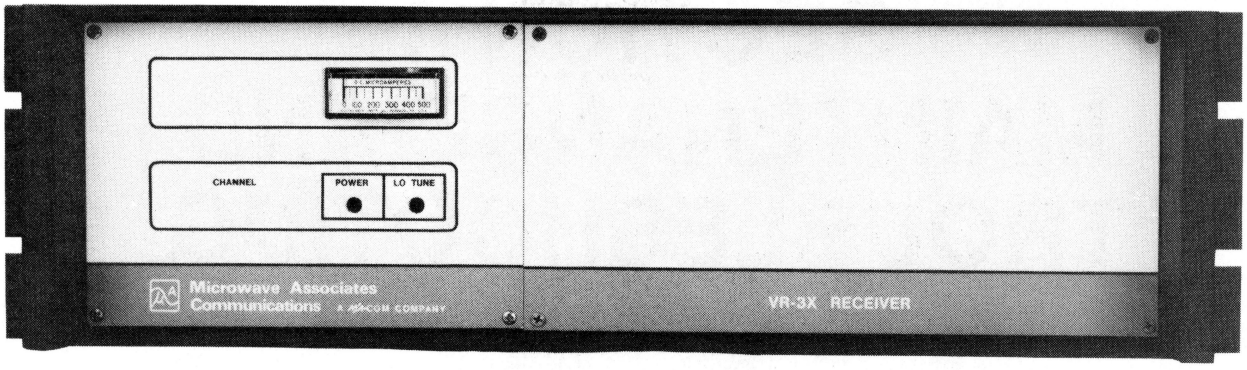


Figure 4-1. VR-3X Satellite Receiver – Front View
(Front Panel Down)

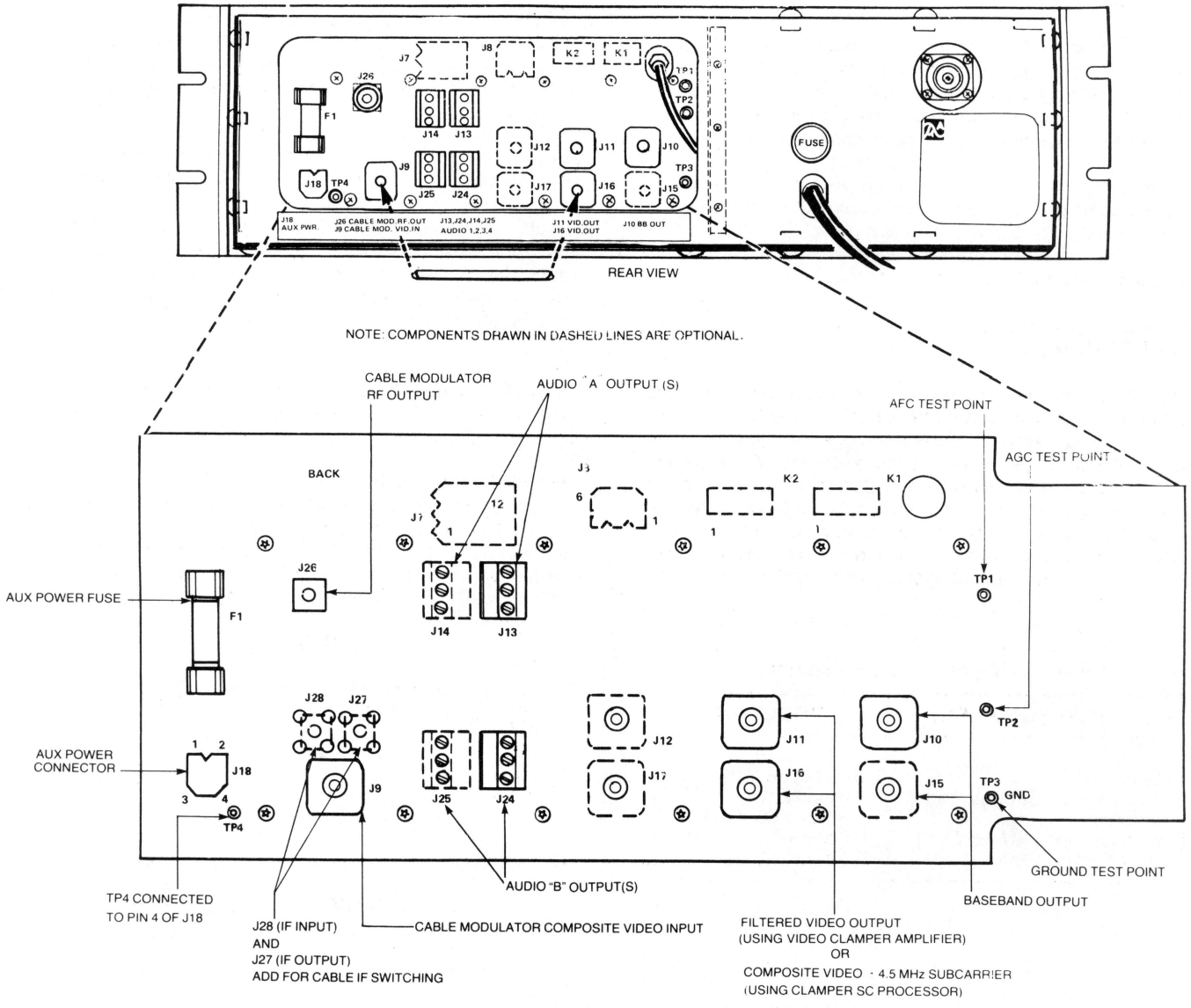


Figure 4-2. VR-3X Satellite Receiver – Rear View

MAINTENANCE LOG VR-3X S/N _____

DATE	FREQUENCY	AFC @ TP1 (V)	AGC @ TP2 (V)	RCL @ J1 (dBm)	BASEBAND @J10 (V P-P)	VIDEO @ J11 (V P-P)	METER READING			INITIALS
6/4/85	3480	-7.2	+4.16	-45	1	1				LBL.

Figure 4-3. Sample Maintenance Log

Automatic Frequency Control (AFC)

This measurement checks the AFC input to the Local Oscillator (LO).

Measure the AFC at TP1 of the Demodulator module for -7.5 ± 1 Vdc (TP2 is GND).

Record the measurement in the maintenance log.

Receive Carrier Level (RCL)

This measures the RF signal present at the input to the Receiver. To eliminate the need for elaborate microwave test equipment, the measurement is taken from the output of the Downconverter at the IF input to the IF Amplifier. This measurement can only be made with an unmodulated carrier.

The RCL measurement is typically taken during antenna and LNA installation/alignment at the output of the Receiver feedline. As such, the RCL measurement outlined here is increased + 23 dB by the Downconverter.

To measure, turn the Receiver power OFF and remove the IF Amplifier module. Insert the Extender module (PN 1809150), and attach the field strengh meter to J1. Turn power ON. Note this measurement and calculate the RCL by the following formula:

RCL = measured dBm level − 23 dB.

NOTE

If the measured reading is in dBmV, the conversion will be 0 dBm = + 48.75 dBmV.

Record this measurement in the maintenance log.

Turn Receiver power OFF, remove Extender from the unit and reinstall IF Amplifier module.

Automatic Gain Control (AGC)

The AGC is measured at dc test point (TP2) on the rear panel (motherboard). The TP2 level is typically + 2 to + 4 Vdc.

Record this measurement in the maintenance log.

Baseband

The baseband output from the Demodulator can be measured at J10 on the rear panel (motherboard) and optional J15.

Measure the output at J10 for 1V P-P ± 1 IRE unit, excluding subcarriers.

If necessary, adjust R30 for the proper output.

NOTE

If R30 is adjusted, downline stages will require adjustment.

Record the measurement in the maintenance log.

Video

Configuration A and B. Measure the video level at the output of the Video Clamper/SC Processor module. The outputs, J11 and J16, are located on the rear panel (motherboard).

CAUTION

The following level adjustments will affect the percentage of modulation and interact. Adjusting one may require adjusting the others. Adjusting R86 requires a 75 ohm input probe and/or the Cable Modulator module.

The video output, including the 4.5 MHz subcarrier, should be 1V P-P ±1 IRE unit. If necessary, adjust R9 for the proper output.

The 4.5 MHz subcarrier level is measured at J11 (and/or J16) for 100 mV P-P (14 IRE units). If necessary, adjust R24 for proper output.

Record this measurement in the maintenance log.

Configuration C. Measure the video level at the outputof the Video Clamper Amplifier module. The outputs, J11 and J16, are located on the rear panel (motherboard).

Measure 1V P-P ±1 IRE unit. If required, adjust R6 on the Video Clamper Amplifier.

Record this measurement in the maintenance log.

Audio

Depending on the number of Audio Demodulators used, the outputs are measured at J13, J24, and J14, J25 on the rear panel (motherboard).

Configuration A, B, and C. During Teat periods, with a 1kHz test tone input at 75 peak deviatoin, measure the outputs for +9 dBm. If necessary, adjust R113 (Channel A) and R213 (Channel B) for proper output.

Record this measurement in the maintenance log.

MODULE REPLACEMENT

Positions of the module interconnect cables' jacks are shown in Figure 4-4.

CAUTION

Before removing any modules, first unplug the Receiver and remove it from the rack.

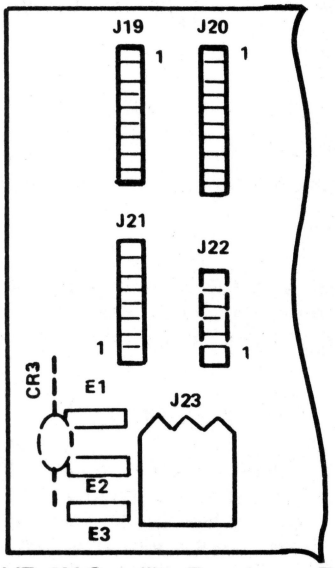


Figure 4-4. VR-3X Satellite Receiver – Rear View Plug Locations on Receiver Backplane

DOWNCONVERTER MODULE. The Downconverter module is removed by:

1. Removing the IF output connector (This is the upper connector on the front of the Downconverter module.). Pull it off gently.

2. Removing the LO input (This is a semi-rigid cable assembly attached by a screw-in type SMA connector. This connector is located near the bottom of the front of the Downconverter module.).

3. Unplug the power cable (One end of this cable is soldered to a ground lug and a feedthrough terminal on the front of the Downconverter. The other end, P19, is then unplugged from the Receiver Backplane Interconnect.).

4. Turn the Receiver on its side and, while holding the Downconverter, remove the three Phillips screws which secure it in place from the bottom of the chassis. Once freed, the Downconverter lifts out of the chassis.

5. The Downconverter is replaced by reversing the above procedure.

POWER SUPPLY MODULE. The Power Supply is removed by:

1. Unplugging P23 from the Receiver Backplane Interconnect.

2. Place the Receiver on its side and, while holding the Power Supply in one hand, remove four Phillips screws which secure it in place from the bottom of the chassis.

3. The Power Supply is replaced by reversing the above procedure.

METER PANEL ASSEMBLY. The Meter Panel Assembly is removed as follows:

1. Unplug P20 from J20 on the backplane.

2. Remove the four screws which secure the panel to the chassis.

The Meter Panel Assembly is replaced by reversing the above procedure.

The Local Oscillator Assembly is replaced as follows:

1. Unplug P21 from J21 on the backplane.

2. Unscrew the semi-rigid cable (SMA connector) between the Local Oscillator and the Downconverter at the Local Oscillator end.

3. Turn the Receiver on its side and, while holding the Local Oscillator, remove the two screws which secure it in place from the bottom of the chassis.

The LO is replaced by reversing the above procedure.

OTHER MODULES (IF Amplifier, Demodulator, Cable Modulator(s), Clamper and Subcarrier Demodulator(s) Modules). The other modules are located behind the front panel of the Receiver. The front panel is removed by unscrewing the four captive screws and lifting out. Each of the modules is removed (a jumper cable between the IF and Demodulator modules is disconnected by pulling the end connectors off the chassis connectors) by grasping the front edge and pulling straight out of the radio. Each is replaced by seating it in the upper and lower tracks and sliding it in until its edge connector is firmly seated in the motherboard (replace the jumper between the IF and Demodulator modules if necessary).

TROUBLESHOOTING

The block diagram, Figure 4-5, gives a functional description of the modules, their stages, and the various pins and test points available for troubleshooting measurements. Use the functional block diagram and the maintenance procedures to isolate any fault. Also a recommended spare parts list is shown in Table 4-2.

Table 4-2. Recommended Spares List

MODULE	MAC PART NO.
Power Supply	
115 Vac	1808328-1
230 Vac	1808328-2
Downconverter	1808390-1
Local Oscillator	1808402-1
Meter Panel Assembly	1808225-1
IF Amplifier	1808340-1
Demodulator	1808336-1
Video Clamper Amplifier	1808282-1
Video Clamper/Subcarrier Processor*	1808482
Single Subcarrier Demodulator*	1808398
Dual Subcarrier Demodulator*	1808398
Card Extender Kit	1809150
Accessory Kit**	
115 Vac	1809165-1
230 Vac	1809166-1
Cable Modulator Option [consists of IF Modulator, RF Converter, and Cable (BNC to BNC)***	1808615

*Specify subcarrier frequency (or frequencies).
**Contains spare line fuse, accessory fuse, four 12-24 x 1/2"screws and four #10 washers.
***Specify channel frequency.

MAINTENANCE LOG VR-3X S/N _____

DATE	FREQUENCY	AFC @ TP1 (V)	AGC @ TP2 (V)	RCL @ J1 (dBm)	BASEBAND @J10 (V P-P)	VIDEO @ J11 (V P-P)	METER READING			INITIALS

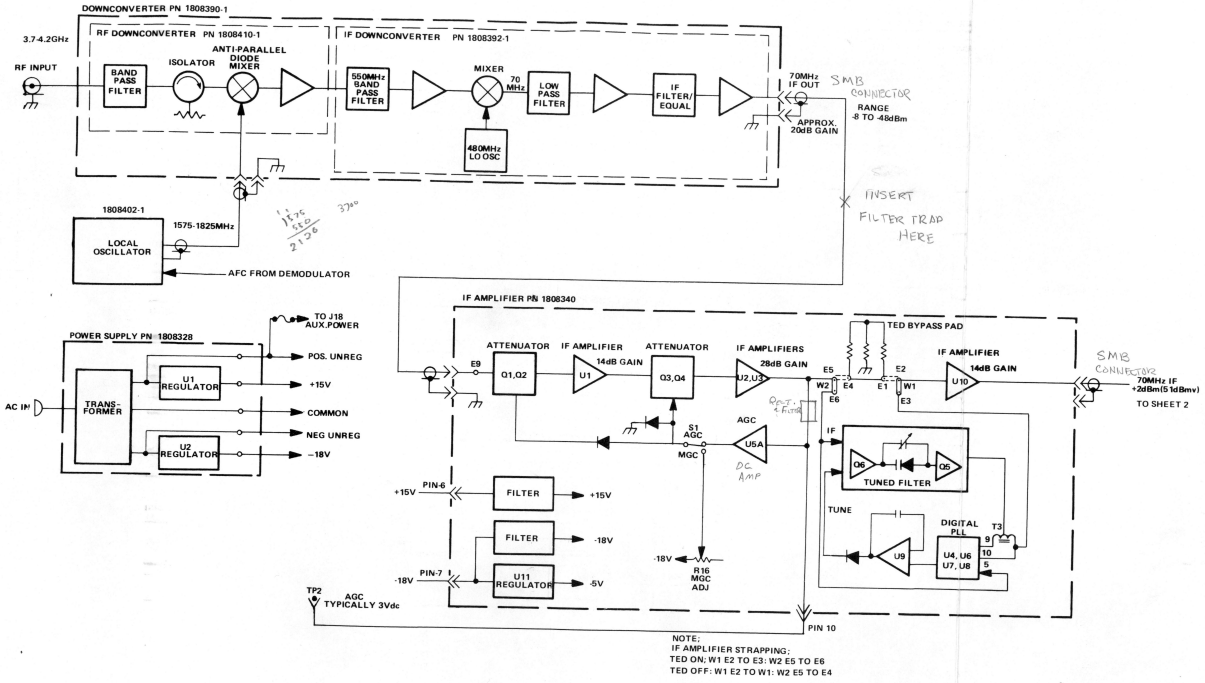


Figure 4-5. VR-3X Satellite Receiver – Functional Block Diagram (Sheet 1 of 4)

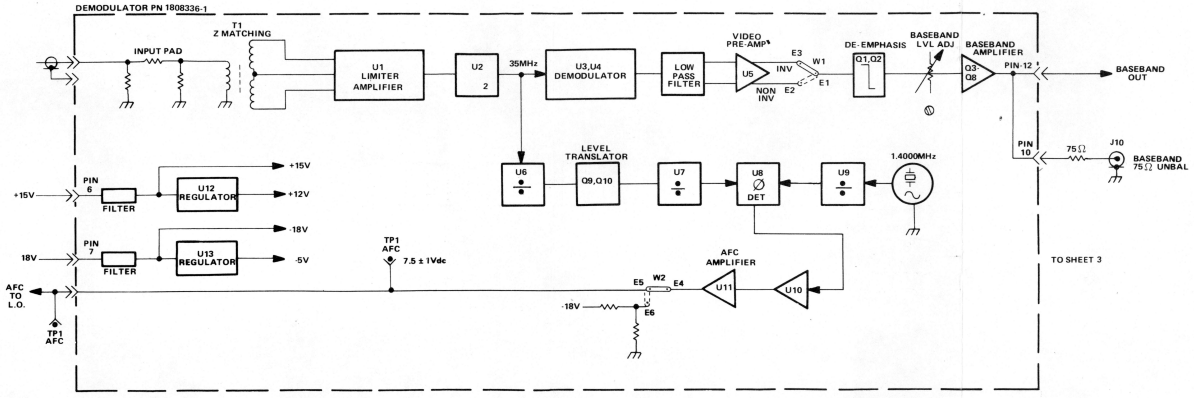


Figure 4-5. VR-3X Satellite Receiver – Functional Block Diagram (Sheet 2 of 4)

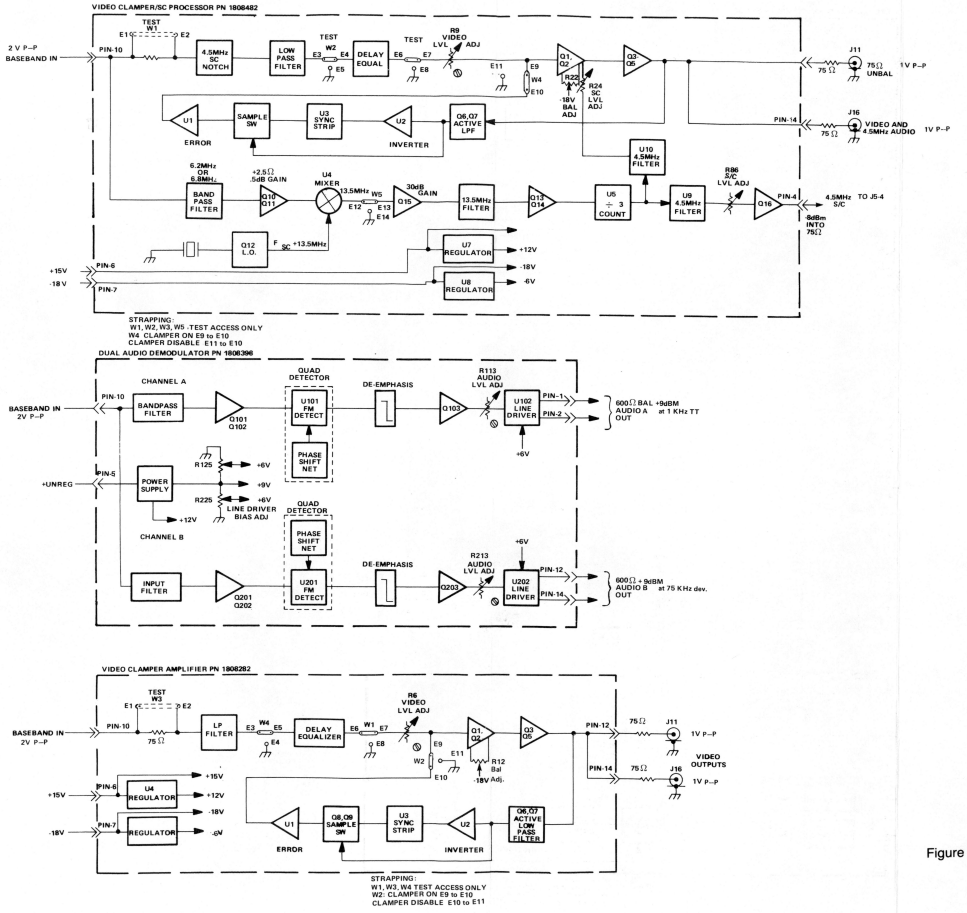


Figure 4-5. VR-3X Satellite Receiver – Functional Block Diagram (Sheet 3 of 4)

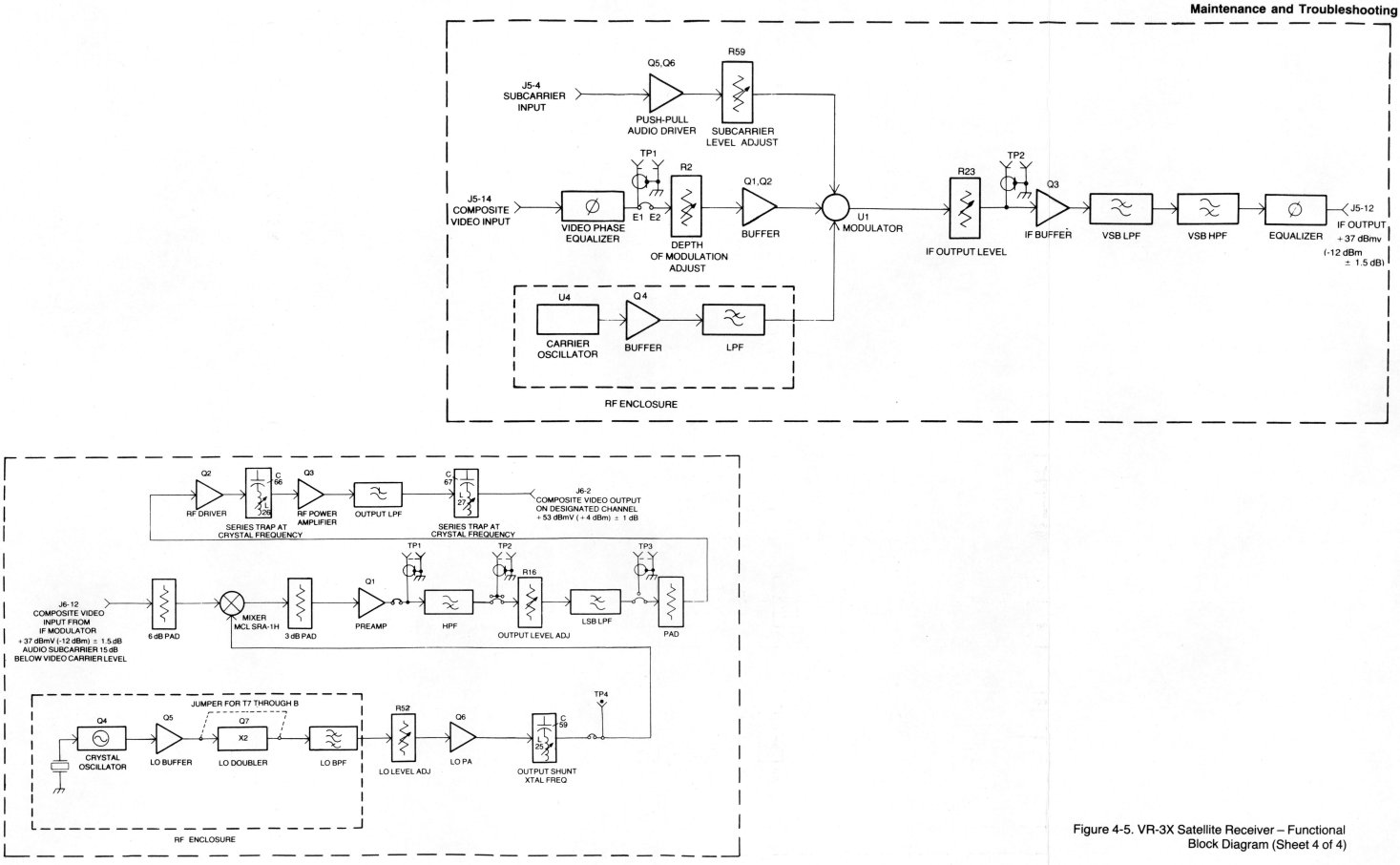


Figure 4-5. VR-3X Satellite Receiver – Functional Block Diagram (Sheet 4 of 4)

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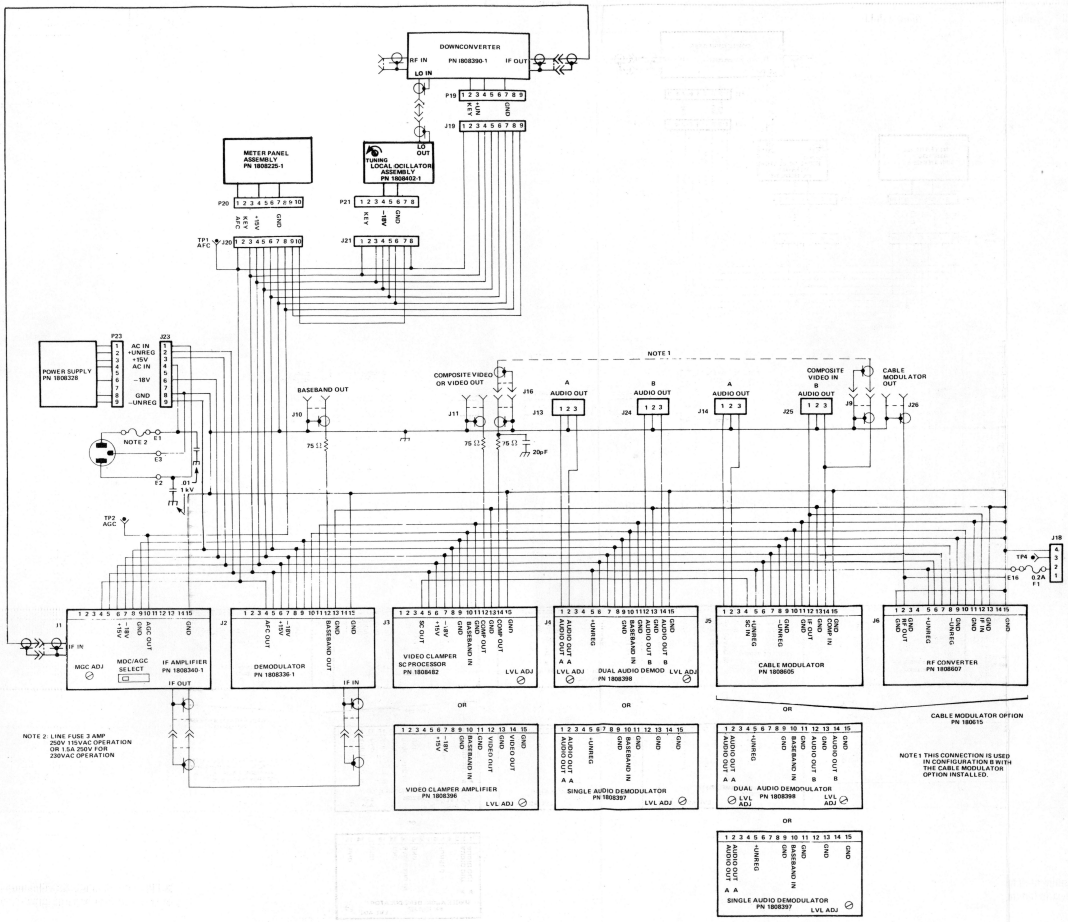
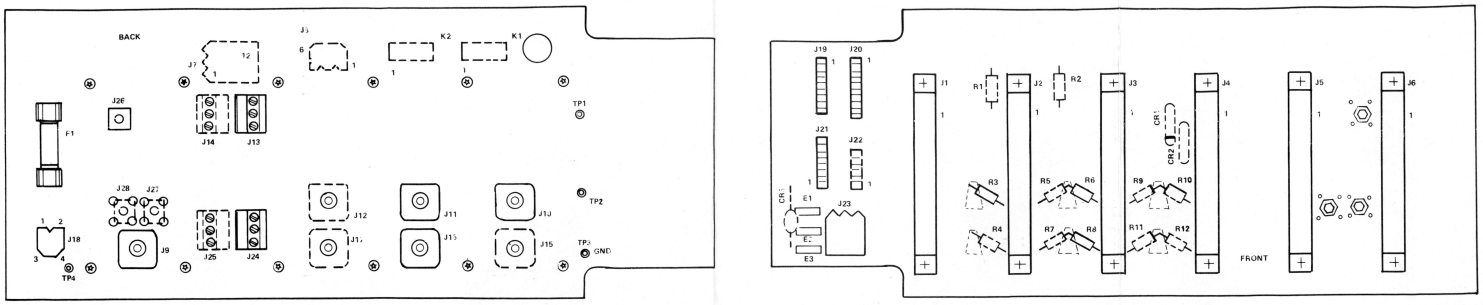

DOWNCONVERTER
PN 1808390-1
RF IN
IF OUT
LO IN
METER PANEL ASSEMBLY PN 1808225-1
LO OUT
TUNING LOCAL OSCILLATOR ASSEMBLY PN 1808402-1
POWER SUPPLY PN 1808328
AC IN +UNREG +15V AC IN -18V GND -UNREG
BASEBAND OUT
COMPOSITE VIDEO OR VIDEO OUT
A AUDIO OUT
B AUDIO OUT
A AUDIO OUT
COMPOSITE VIDEO IN B AUDIO OUT
CABLE MODULATOR OUT
NOTE 1
NOTE 2
TP1 AFC
TP2 AGC
IF AMPLIFIER PN 1808340-1
MGC ADJ
MDC/AGC SELECT
DEMODULATOR PN 1808336-1
VIDEO CLAMPER SC PROCESSOR PN 1808482
LVL ADJ
DUAL AUDIO DEMOD PN 1808398
CABLE MODULATOR PN 1808605
RF CONVERTER PN 1808607
CABLE MODULATOR OPTION PN 180615
VIDEO CLAMPER AMPLIFIER PN 1808396
SINGLE AUDIO DEMODULATOR PN 1808397
DUAL AUDIO DEMODULATOR PN 1808398
OR
NOTE 2: LINE FUSE 3 AMP 250V 115VAC OPERATION OR 1.5A 250V FOR 230VAC OPERATION
NOTE1 THIS CONNECTION IS USED IN CONFIGURATION B WITH THE CABLE MODULATOR OPTION INSTALLED.

Figure 5-1. VR-3X Satellite Receiver – Interconnection Wiring Diagram



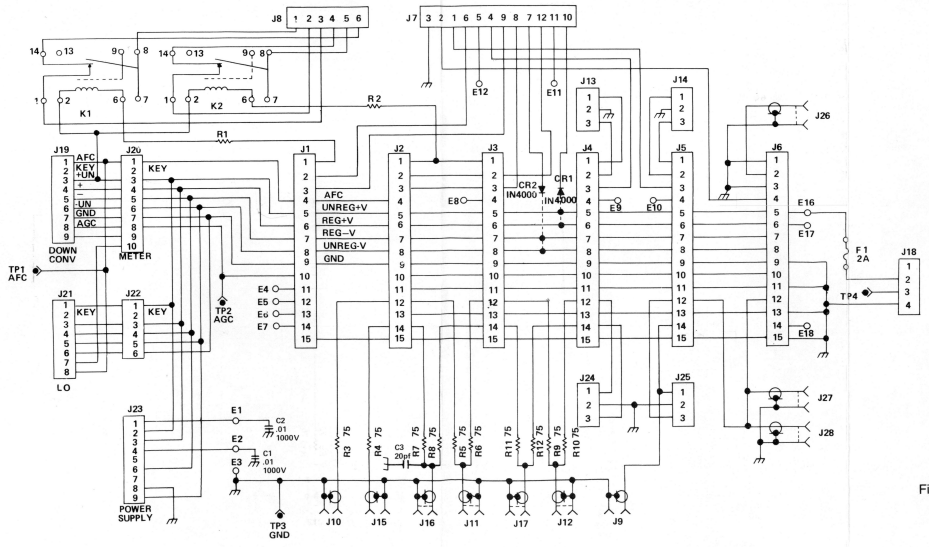
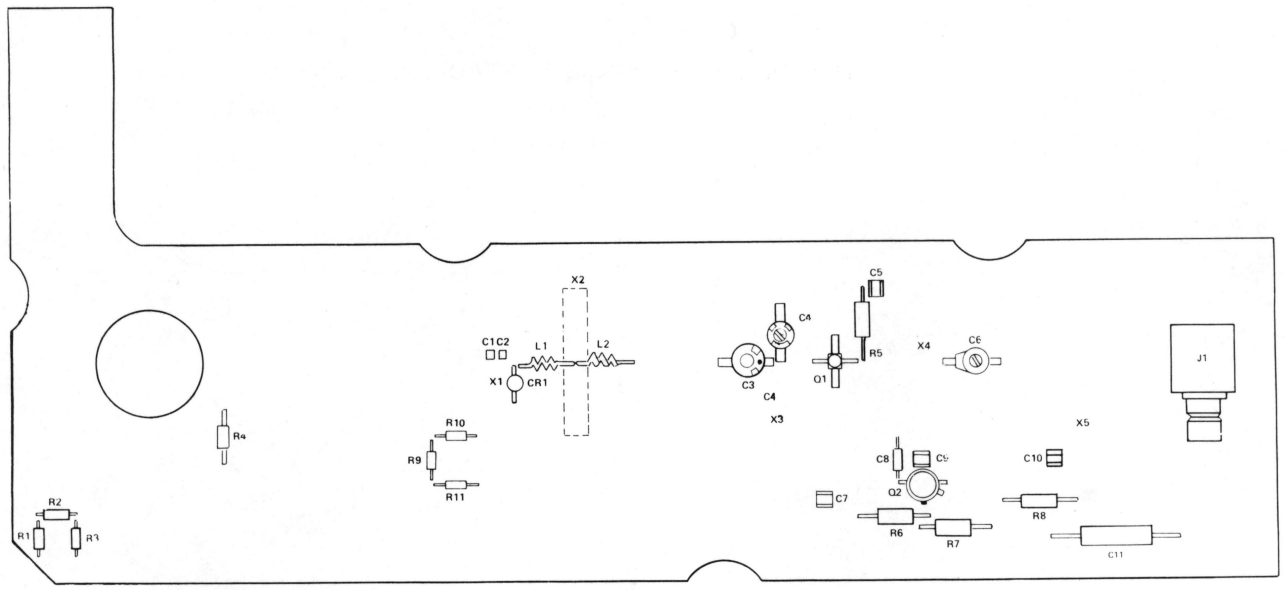


Figure 5-2. Backplane Interconnection – Component Locations/Schematic Diagram PN 1808458



ANTI-PARALLEL DIODE MIXER

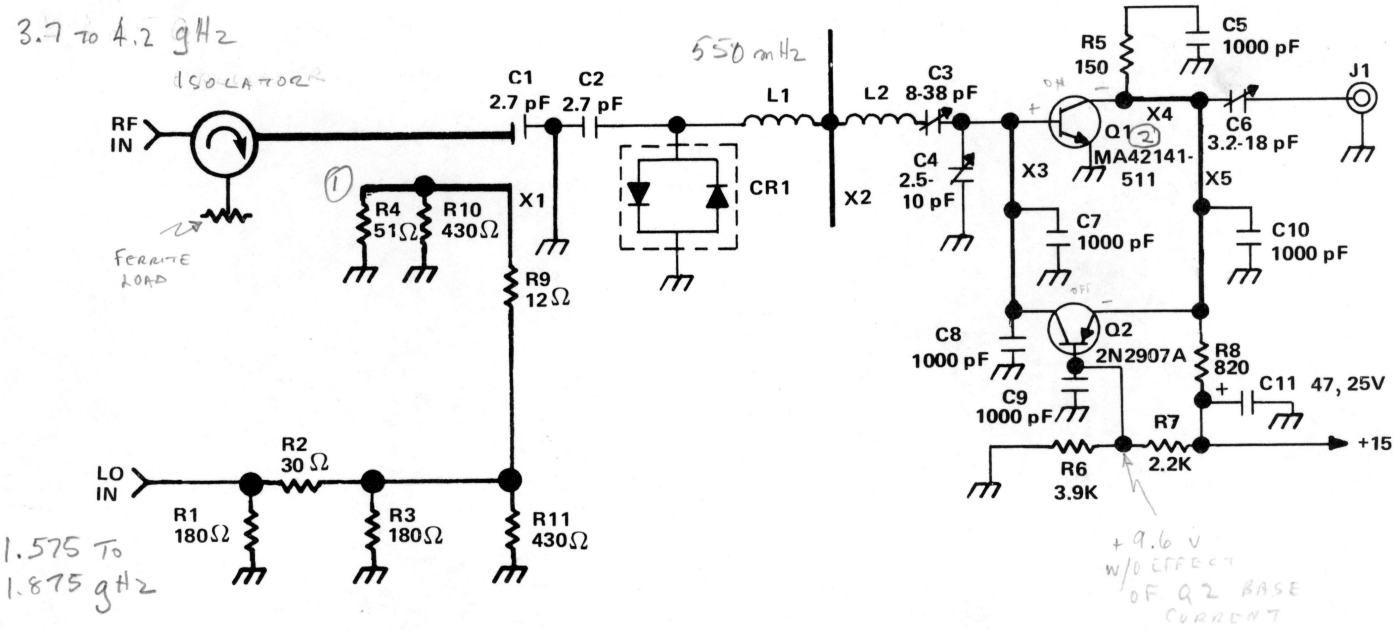
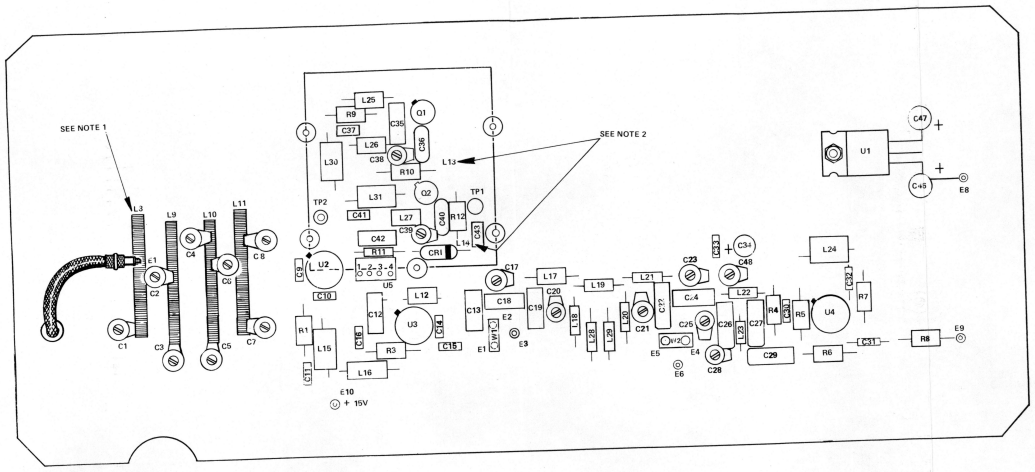


Figure 5-3. RF Downconverter – Component Locations/Schematic Diagram
PN 1808410 (P/O 1808390)

(2) SUBSTITUTE 2N6603

(1) ACTUALLY THE 2nd HARMONIC OF THE LO IS USED. CR1 DIODES ACT AS A DOUBLER FOR LO OSC



NOTES:

1. L8 THRU L11 ARE COPPER ETCH ON TOP SIDE SERVING AS COILS.
2. L13 and L14 ARE COPPER ETCH ON BOTTOM SIDE SERVING AS COILS.

Figure 5-4. IF Downconverter – Component Locations PN 1808392 (P/O 1808390)

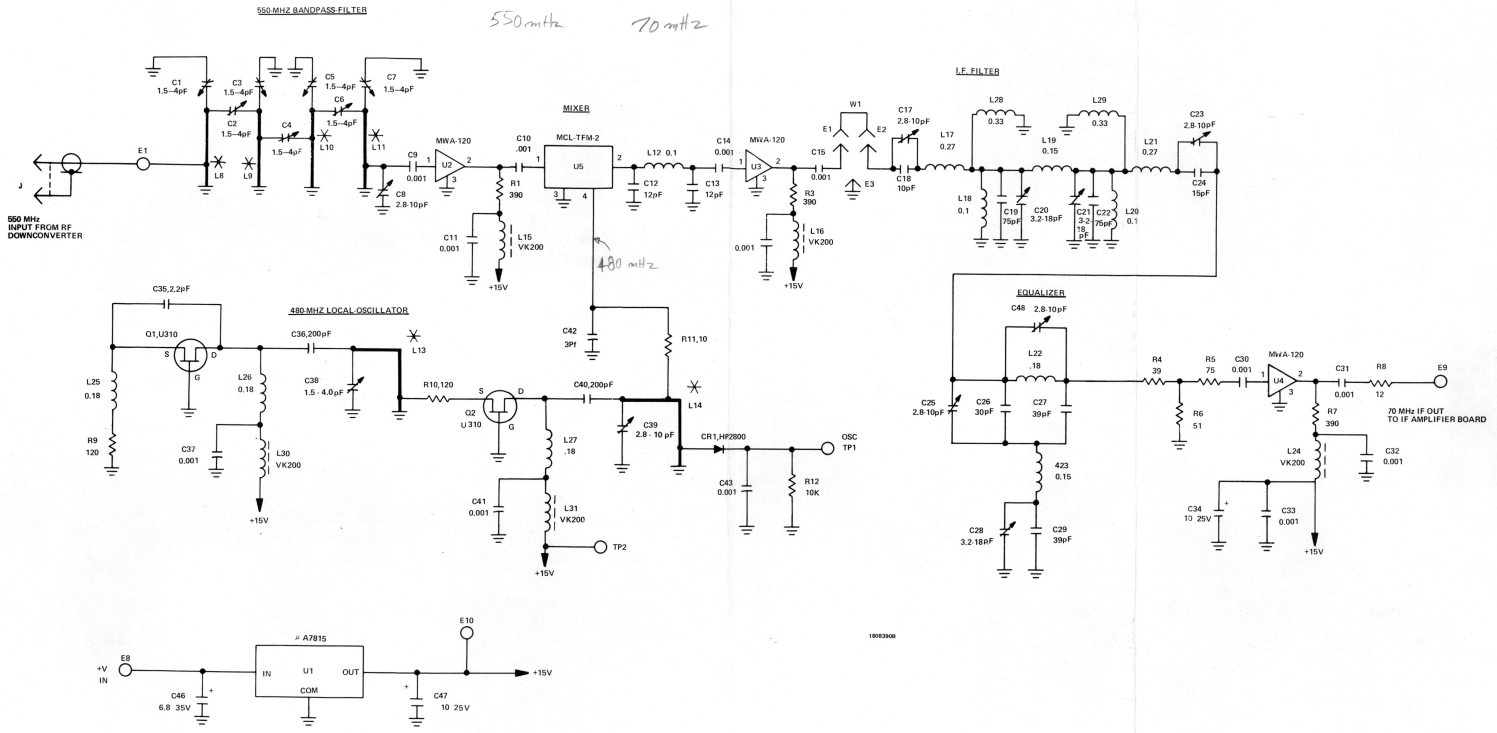
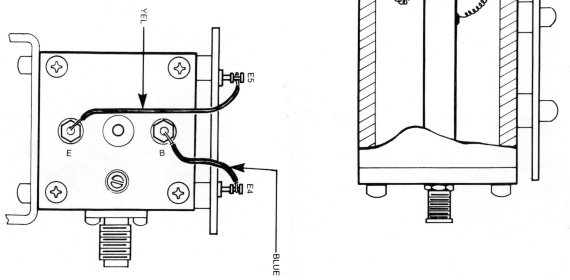
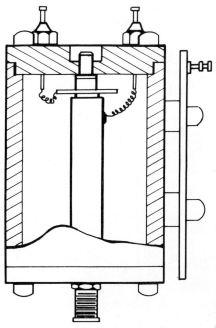
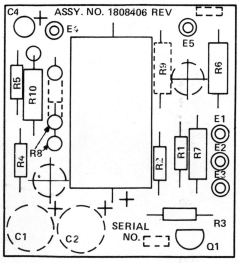
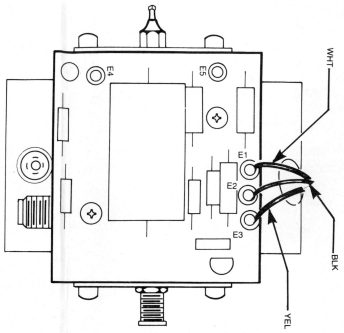


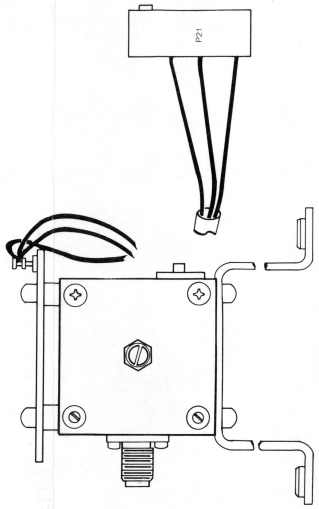
Figure 5-5. IF Downconverter – Schematic Diagram
PN 1808392 (P/O 1808390)

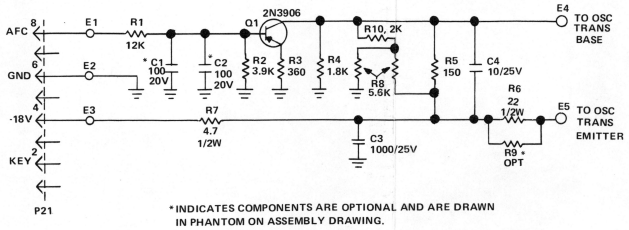












*INDICATES COMPONENTS ARE OPTIONAL AND ARE DRAWN IN PHANTOM ON ASSEMBLY DRAWING.

Figure 5-6. Local Oscillator AFC Bias Board – Component Locations/Schematic Diagram PN 1808406 (P/O 1808402)

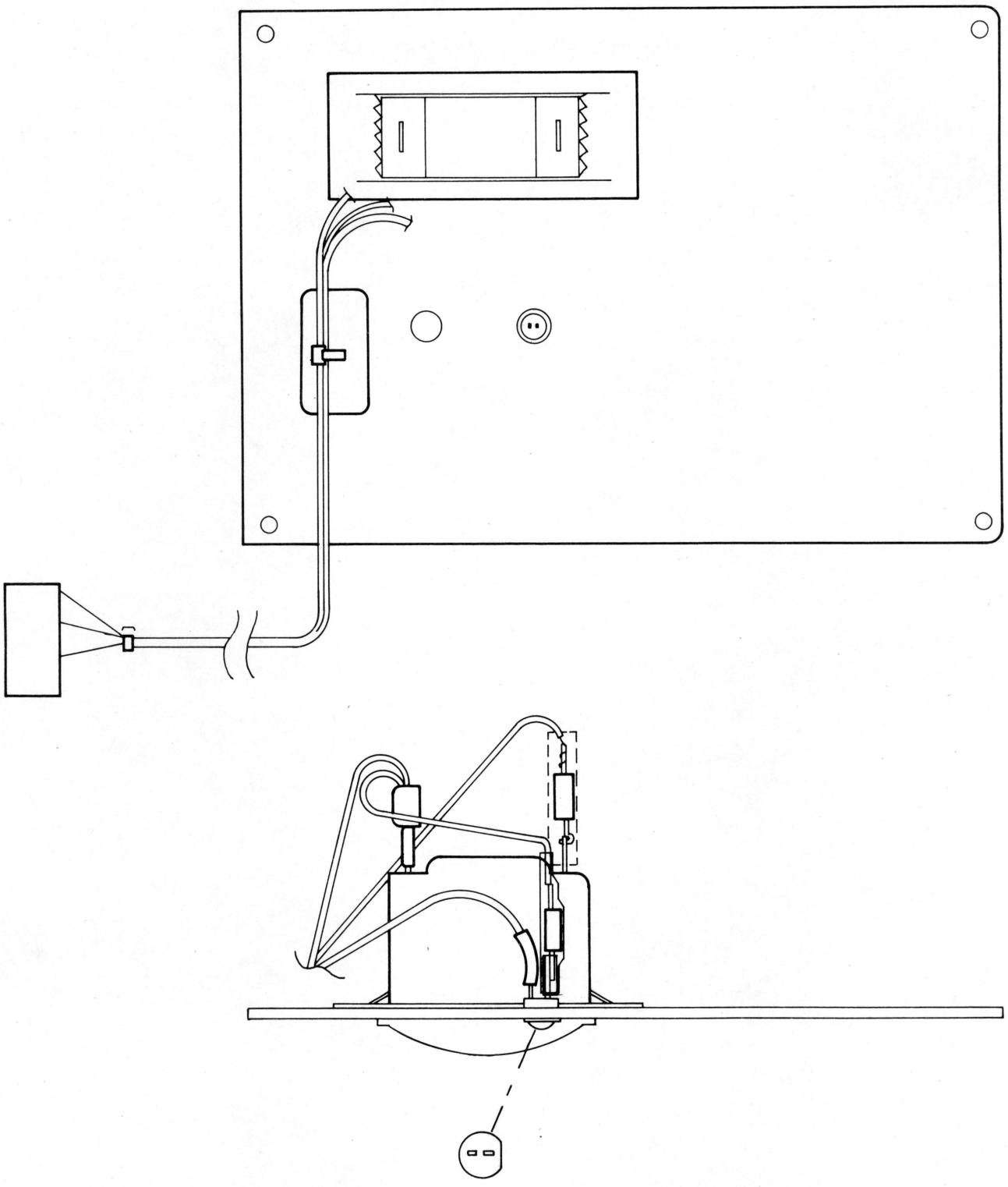


Figure 5-7. Meter Panel Assembly – Component Locations
PN 1808225-1

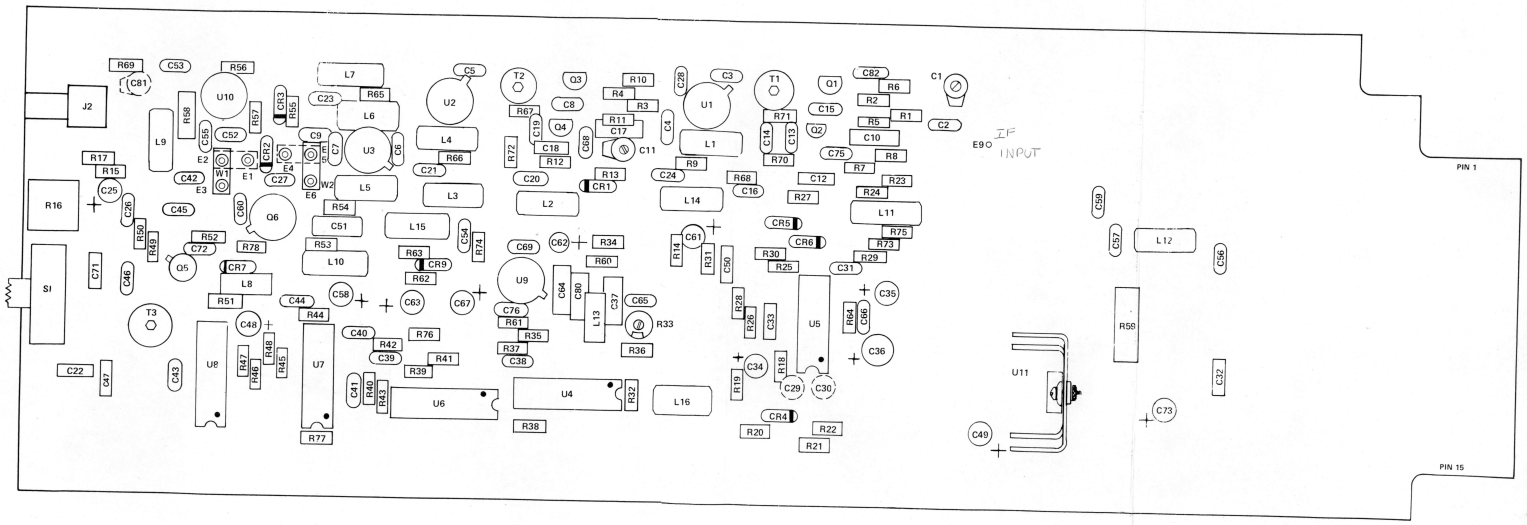
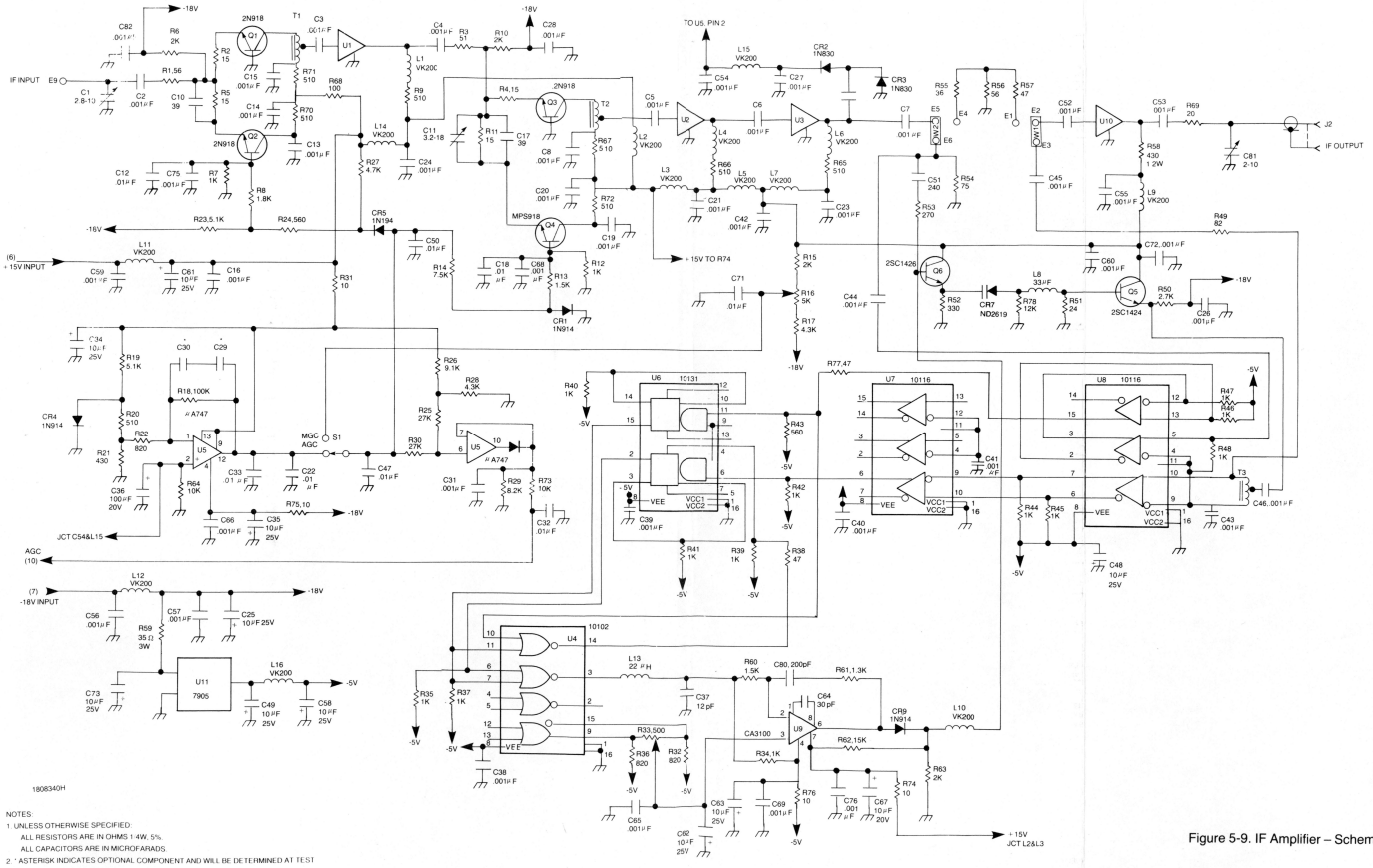
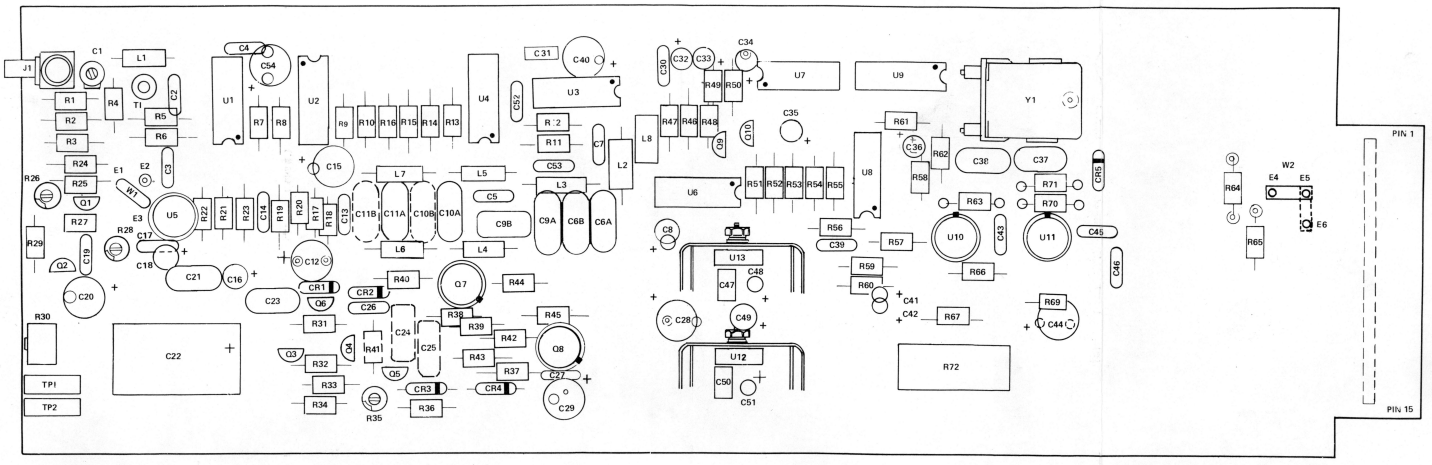


Figure 5-8. IF Amplifier – Component Locations
PN 1808340



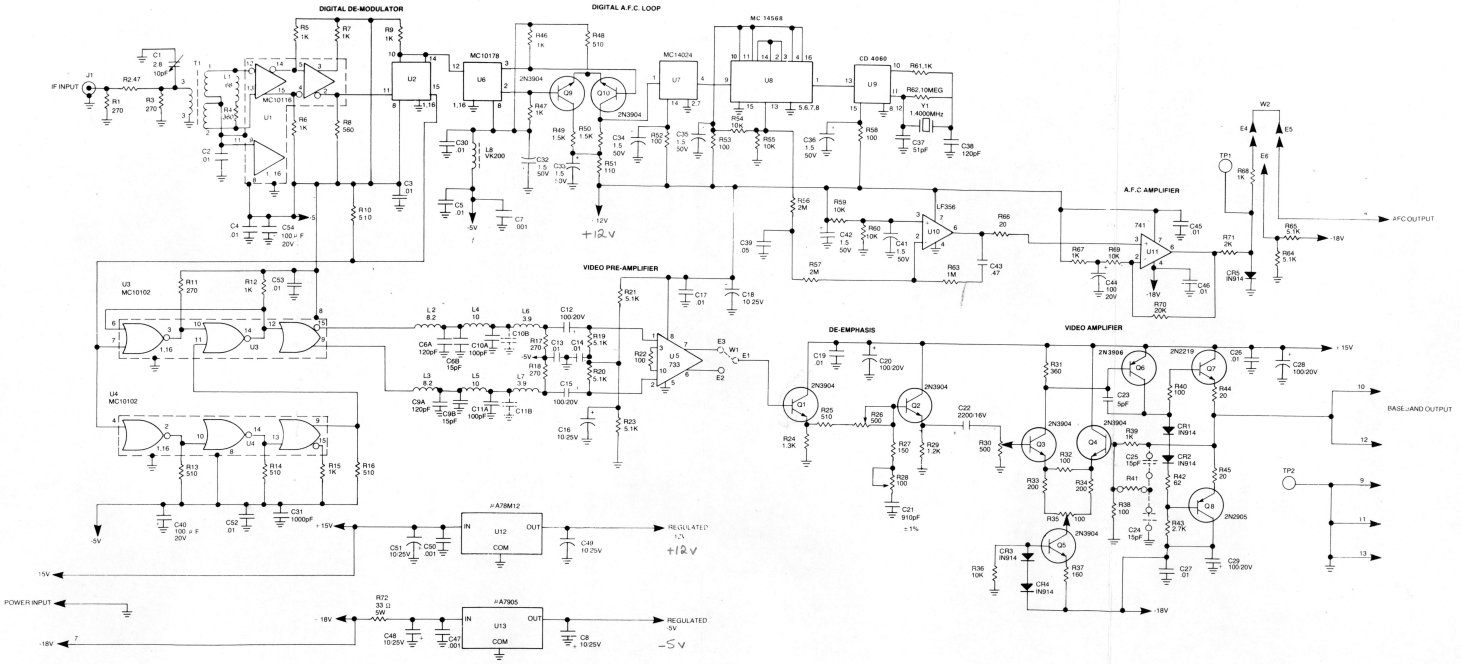
NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   ALL RESISTORS ARE IN OHMS 1/4W, 5%.
   ALL CAPACITORS ARE IN MICROFARADS.
2. * ASTERISK INDICATES OPTIONAL COMPONENT AND WILL BE DETERMINED AT TEST.

Figure 5-9. IF Amplifier – Schematic Diagram
PN 1808340



1808336G

Figure 5-10. Demodulator – Component Locations
PN 1808336



808336

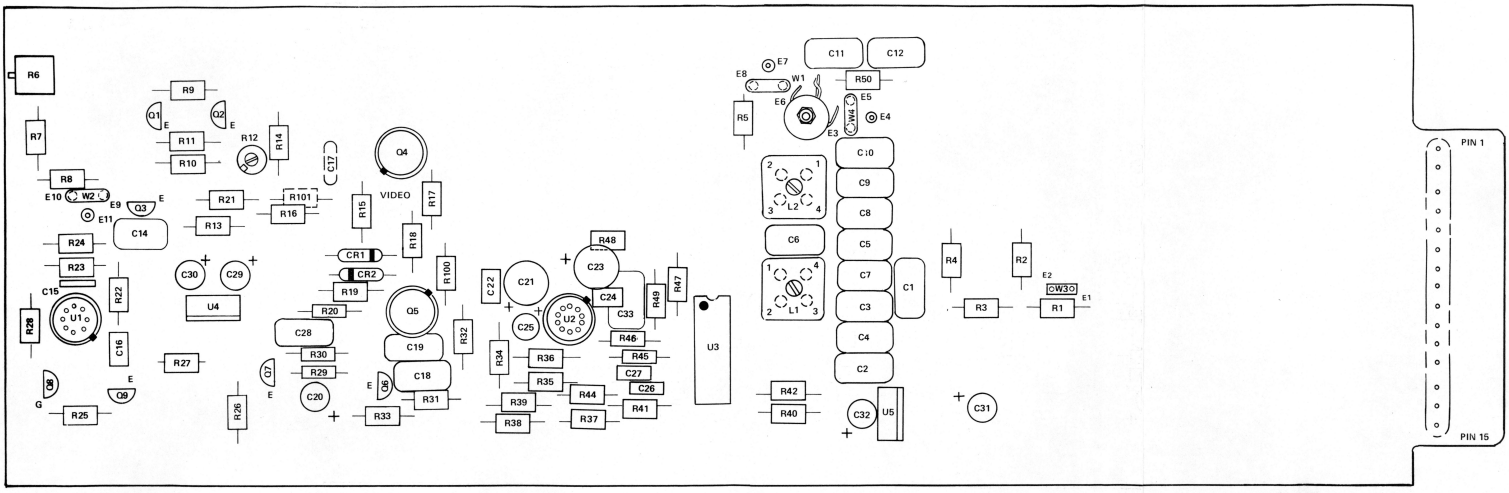
NOTES:

UNLESS OTHERWISE SPECIFIED ALL RESISTORS ARE IN OHM,5,¼ WATT,5%.

ALL CAPACITORS ARE IN MICROFARADS.

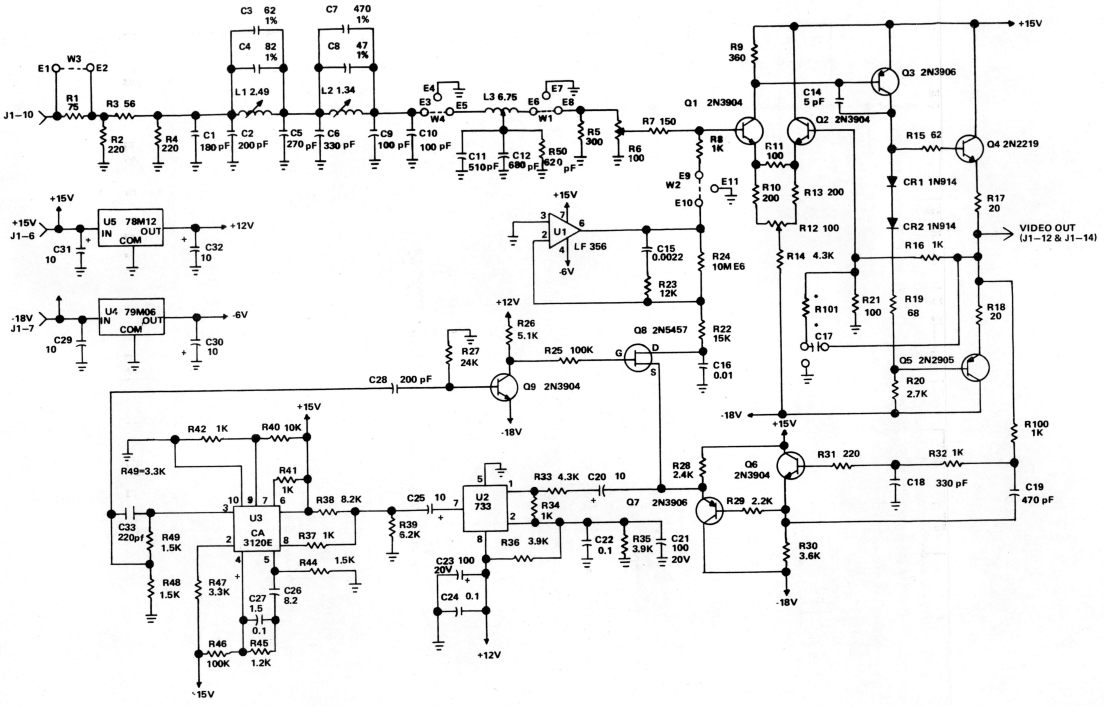
ALL COILS ARE IN MICROHENRIES.

Figure 5-11. Demodulator – Schematic Diagram
PN 1808336



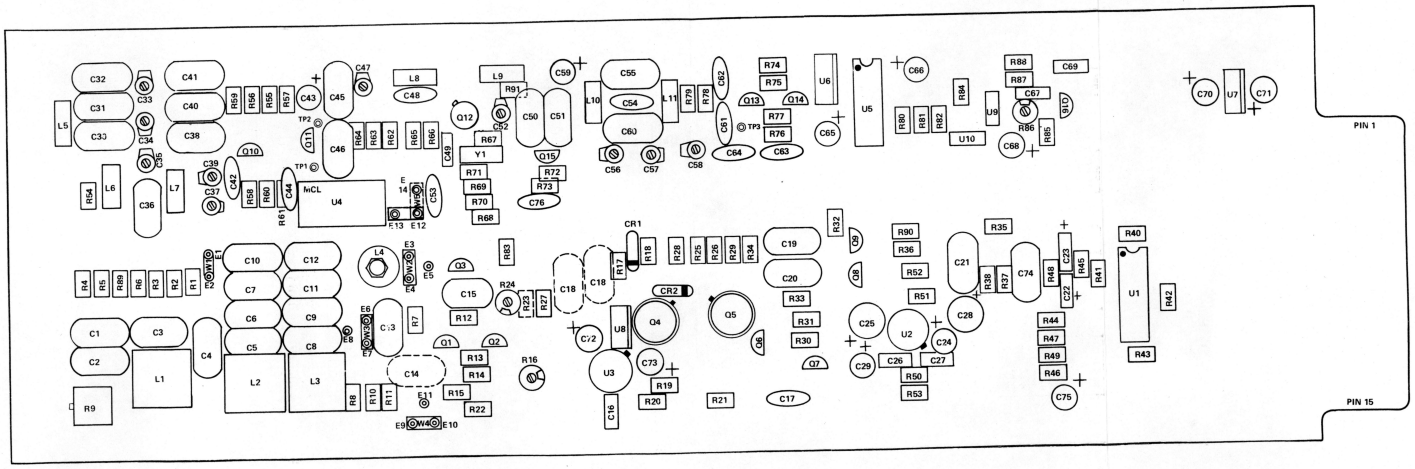
NOTE: OPTIONAL COMPONENTS (R101 & C17) DRAWN IN DASHED LINES.

Figure 5-12. Video Clamper Amplifier – Component Locations PN 1808282



NOTE: ALL CAPACITORS ARE MICROFARADS UNLESS OTHERWISE SPECIFIED.
ALL RESISTORS ARE 1/4W, 5% OHMS UNLESS OTHERWISE SPECIFIED.
ALL COILS ARE IN MICROHENRIES
GND=PINS 9,11,13,15

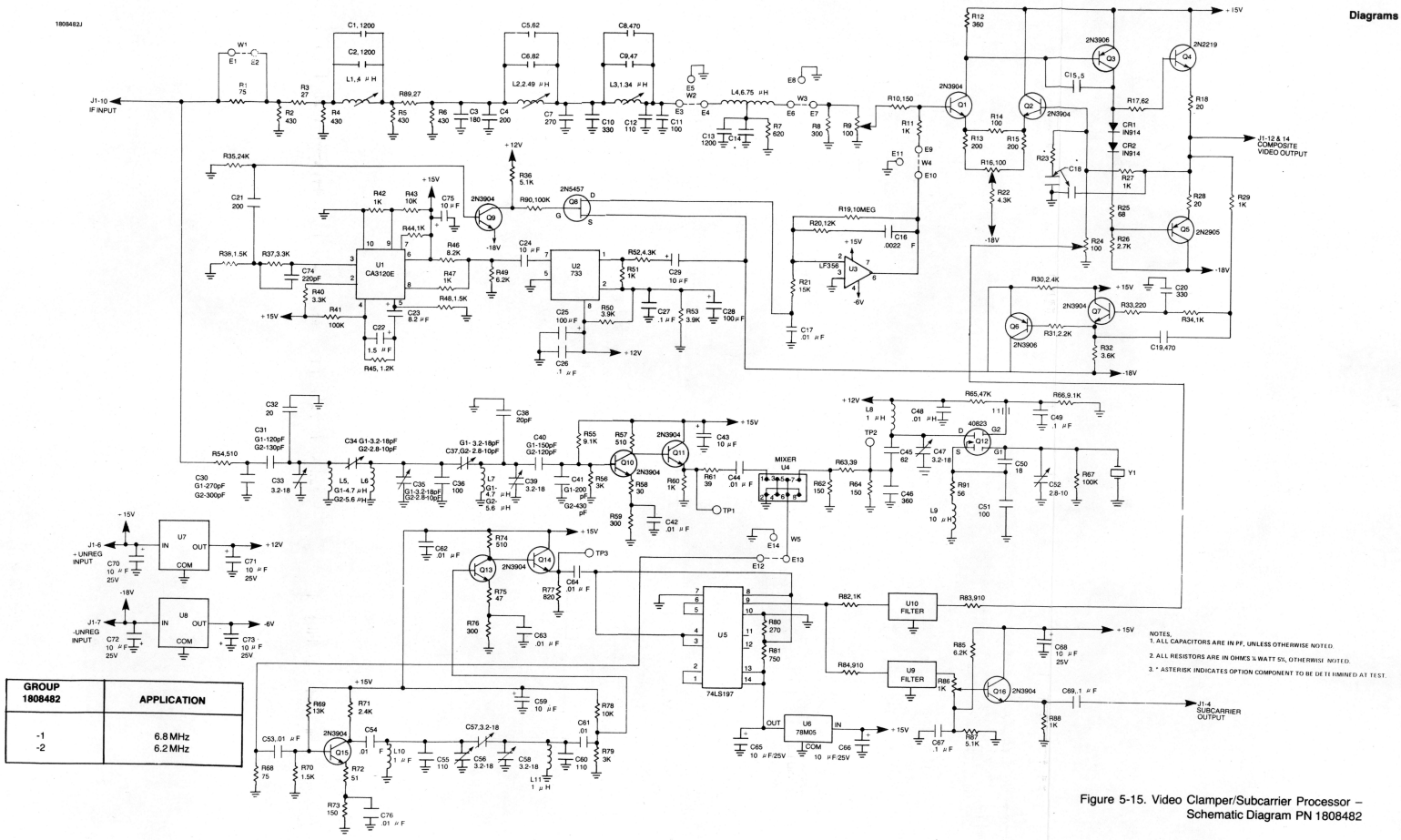
Figure 5-13. Video Clamper Amplifier – Schematic Diagram PN 1808282



1808482J

NOTE: COMPONENTS IN PHANTOM ARE OPTIONAL AND WILL BE DETERMINED AT TEST.

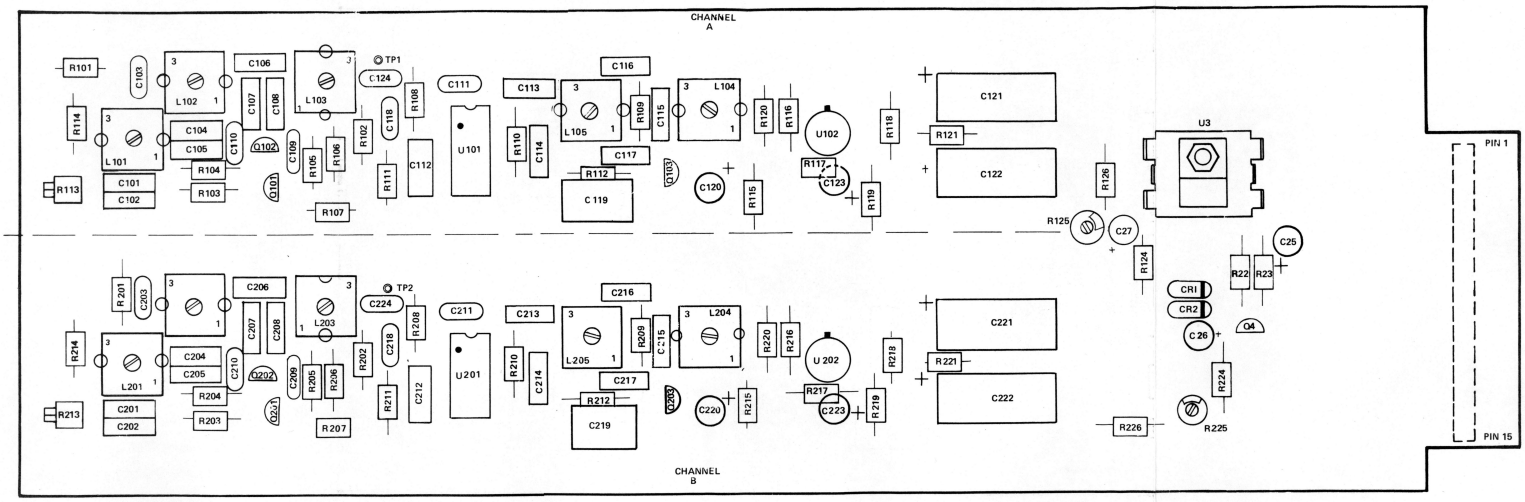
Figure 5-14. Video Clamper/Subcarrier Processor Component Locations PN 1808482



GROUP 1808482	APPLICATION
-1	6.8 MHz
-2	6.2 MHz

NOTES,
1. ALL CAPACITORS ARE IN PF, UNLESS OTHERWISE NOTED.
2. ALL RESISTORS ARE IN OHMS ¼ WATT 5%, OTHERWISE NOTED.
3. * ASTERISK INDICATES OPTION COMPONENT TO BE DETERMINED AT TEST.

Figure 5-15. Video Clamper/Subcarrier Processor – Schematic Diagram PN 1808482

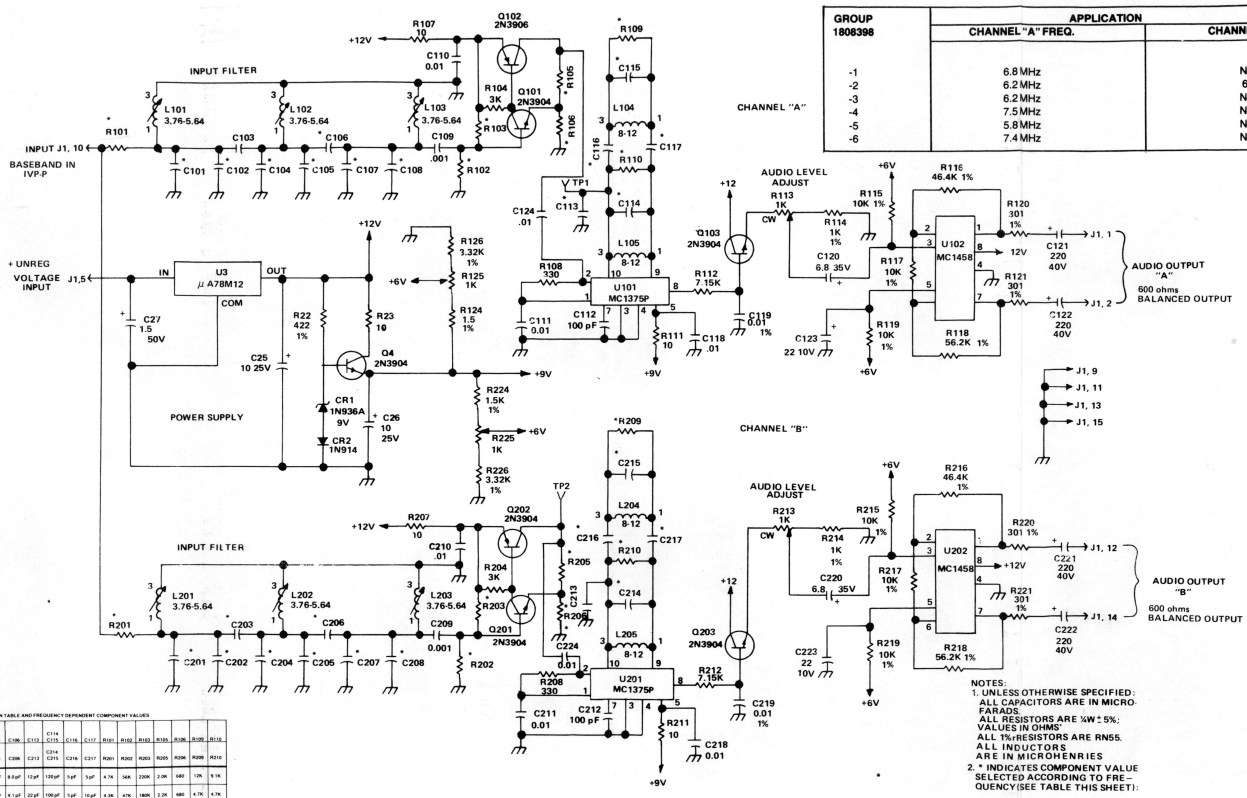


1808398E

Figure 5-16. Dual Audio Demodulator – Component Locations PN 1808398

Table 2

GROUP 1808398	APPLICATION	
	CHANNEL "A" FREQ.	CHANNEL "B" FREQ.
-1	6.8 MHz	Not Used
-2	6.2 MHz	6.8 MHz
-3	6.2 MHz	Not Used
-4	7.5 MHz	Not Used
-5	5.8 MHz	Not Used
-6	7.4 MHz	Not Used



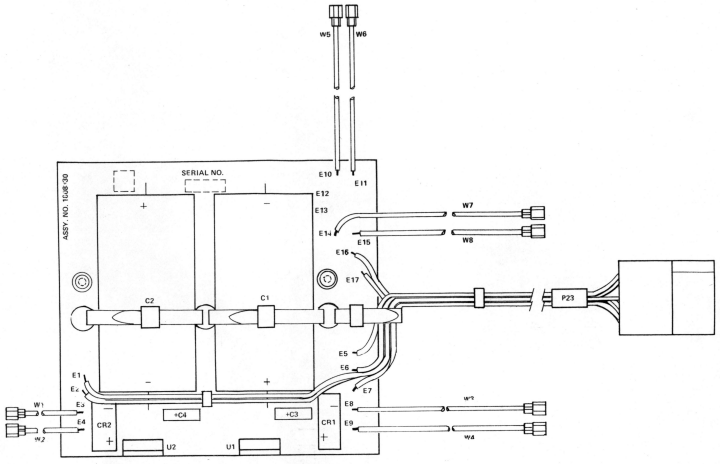
NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   ALL CAPACITORS ARE IN MICROFARADS.
   ALL RESISTORS ARE ¼W ±5%;
   VALUES IN OHMS'
   ALL 1%rRESISTORS ARE RN55.
   ALL INDUCTORS ARE IN MICROHENRIES
2. * INDICATES COMPONENT VALUE SELECTED ACCORDING TO FREQUENCY(SEE TABLE THIS SHEET):

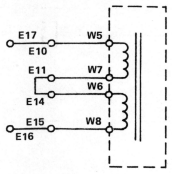
APPLICATION TABLE AND FREQUENCY DEPENDENT COMPONENT VALUES

SUBCARRIER FREQUENCY (MHz)	C101 C104 C107 C201 C204 C207	C102 C105 C108 C202 C205 C208	C103	C106	C113	C114 C115 C214 C215	C116	C117	R101	R102	R103	R105	R106	R109	R110
4.5	220 pF	56 pF N750	5.0 pF	8.0 pF	12 pF	120 pF	5 pF	3 pF	4.7K	56K	220K	2.0K	680	12K	9.1K
4.83	200 pF	47 pF N750	5.0 pF	9.1 pF	22 pF	100 pF	5 pF	10 pF	4.3K	47K	180K	2.2K	680	4.7K	4.7K
6.2	110 pF	22 pF N750	2.2 pF	3.5 pF	12 pF	62 pF	2 pF	2 pF	9.1K	47K	180K	2.4K	560	6.2K	9.2K
6.8	110 pF	22 pF N750	2.2 pF	3.5 pF	10 pF	51 pF	2 pF	2 pF	9.1K	62K	270K	2.4K	560	9.1K	9.1K
7 & 7.5	82 pF	18 pF N750	1.5 pF	2.7 pF	8 pF	39 pF	1 pF	2 pF	9.1K	27K	110K	2.4K	560	12K	12K
5.8	130 pF	22 pF N750	3 pF	5 pF	15 pF	75 pF	3 pF	5 pF	8.2K	47K	180K	2.4K	560	5.6K	5.6K

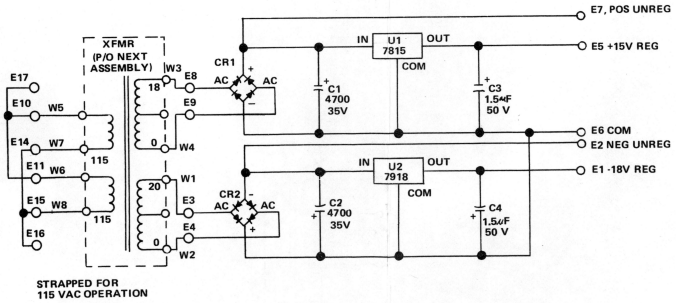
SEE NOTES ON RETUNING IN OTHER MANUAL THIS PAGE.

Figure 5-17. Dual Audio Demodulator – Schematic Diagram PN 1808398





STRAPPED FOR
230 VAC OPERATION



STRAPPED FOR
115 VAC OPERATION

Figure 5-18. Power Supply – Outline/Schematic Diagram
PN 1808330

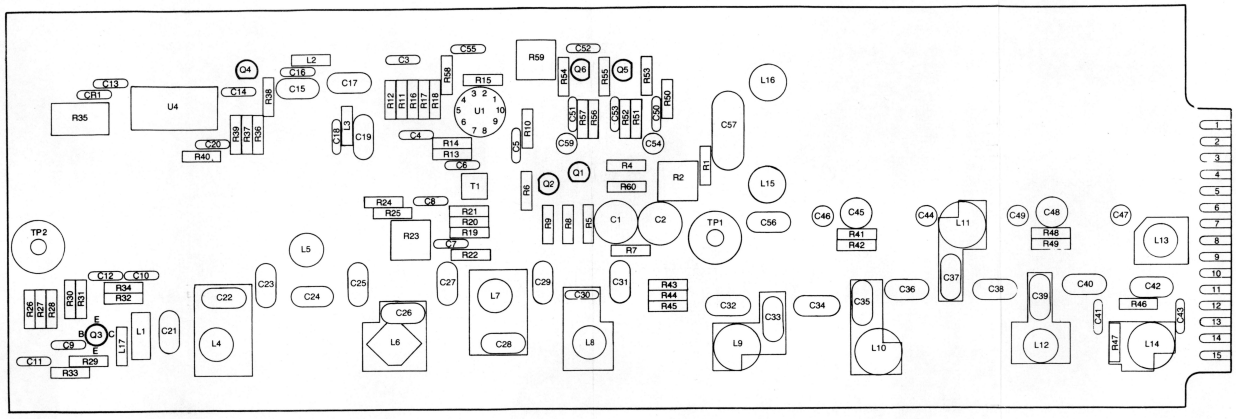


Figure 5-19. IF Modulator (Cable Modulator Option) – Component Locations PN 1808605

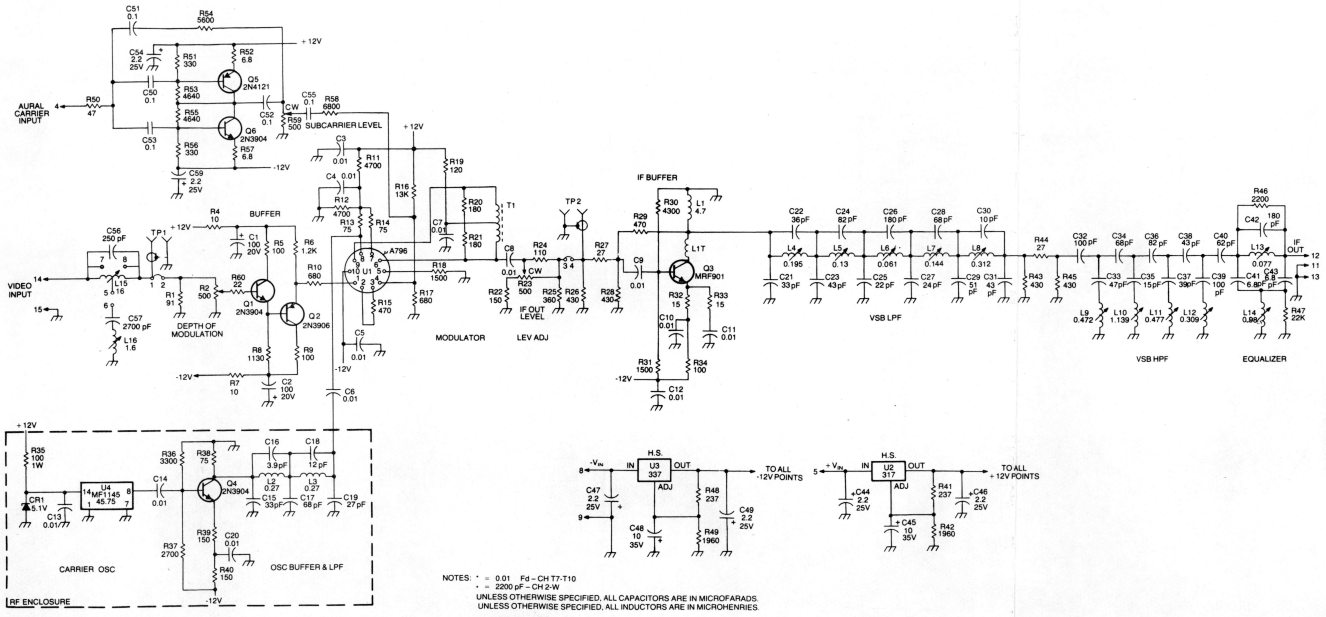


Figure 5-20. IF Modulator (Cable Modulator Option) – Schematic Diagram PN 1808605

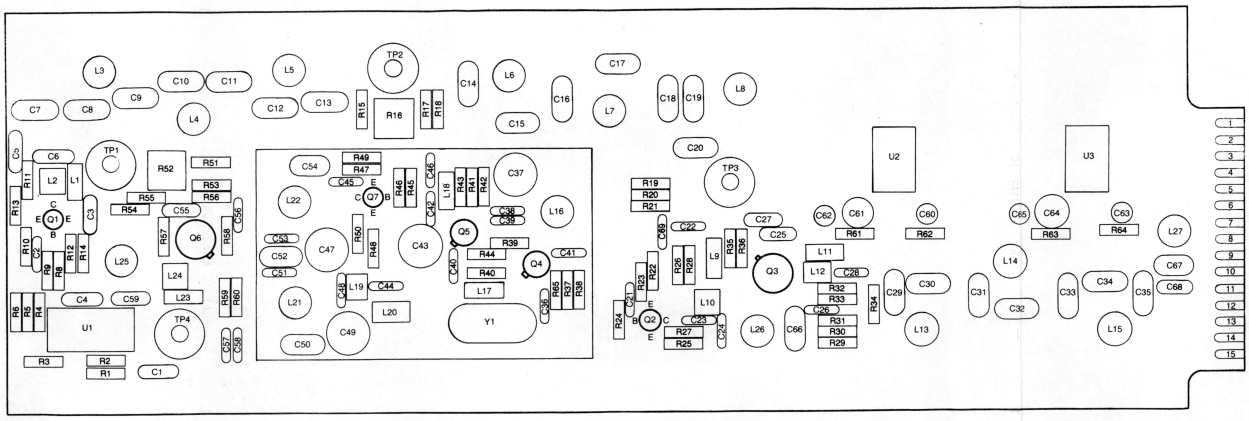
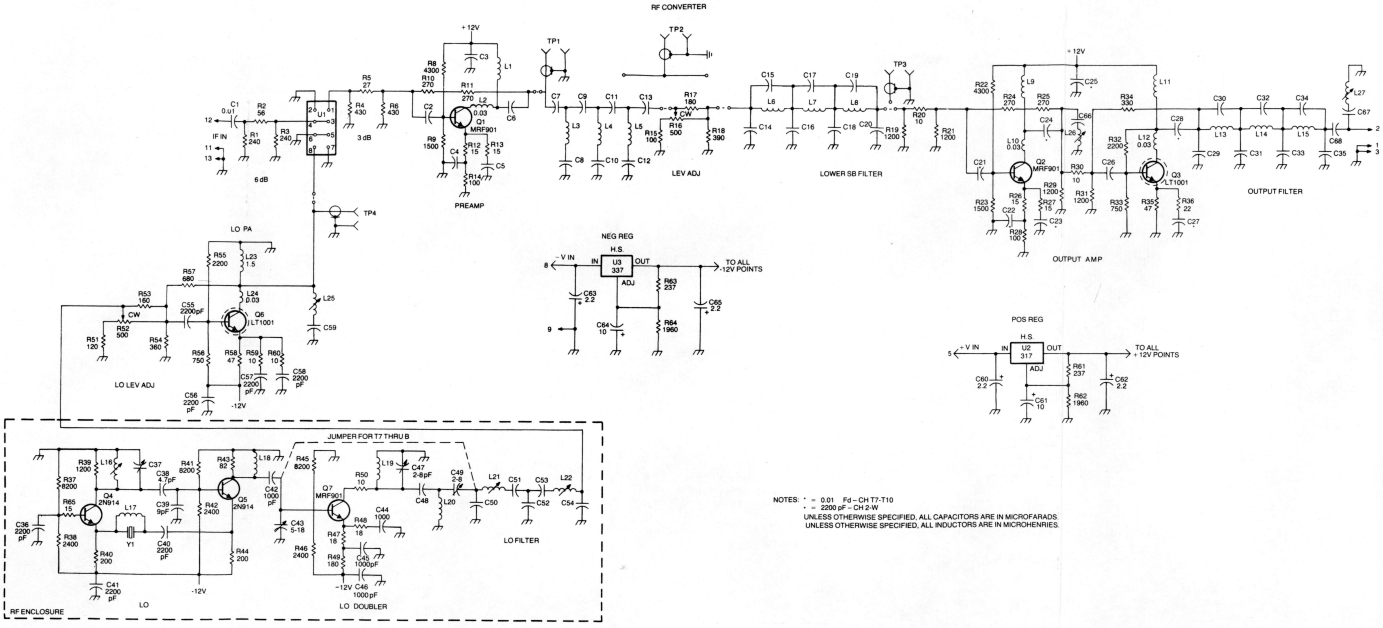


Figure 5-21. RF Converter (Cable Modulator Option) – Component Location PN 1808607



NOTES: * = 0.01 Fd – CH T7-T10
+ = 2200 pF – CH 2-W
UNLESS OTHERWISE SPECIFIED, ALL CAPACITORS ARE IN MICROFARADS.
UNLESS OTHERWISE SPECIFIED, ALL INDUCTORS ARE IN MICROHENRIES.

Figure 5-22. RF Converter (Cable Modulator Option) – Schematic Diagram PN 1808607

SECTION 6
PARTS LISTS

1. VR-3X Receiver PN 1808300 6-2
2. VR-3X Receiver Chassis Assembly PN 1808301 6-3
3. Backplane PWB Assembly PN 1808458-1 6-4
4. Resonator and Transistor Mounting Assembly PN 1808484-2 6-6
5. Meter Panel Assembly PN 1808225 6-7
6. Local Oscillator Assembly PN1808402 6-8
7. AFC Bias Board Assembly PN 1808406 6-9
8. Power Supply PWB Assembly PN 1808328 6-10
9. Downconverter Assembly PN 1808390-1 6-11
10. RF Downconverter PWB Assembly PN 1808410-1 6-12
11. IF Downconverter Assembly PN 1808392-1 6-13
12. IF Amplifier PWB Assembly PN 1808340-1 6-15
13. Demodulator PWB Assembly PN 1808336-1 6-20
14. Video Clamper Amplifier PWB Assembly PN 1808282-1 6-25
15. Video Clamper/Subcarrier Processor PWB Assembly PN 1808482 6-28
16. Audio Demodulator PN 1808398 6-34
17. Audio Demodulator PN 1808398 6-35
18. 6.8 MHz Audio Demodulator PN 1808398-1 6-37
19. 6.2 MHz and 6.8 MHz Audio Demodulator PN 1808398-2 6-38
20. 6.2 MHz Audio Demodulator PN 1808398-3 6-40
21. 7.5 MHz Audio Demodulator PN 1808398-4 6-41
22. 5.8 MHz Audio Demodulator PN 1808398-5 6-42
23. 7.4 MHz Audio Demodulator PN 1808398-6 6-43

VR-3X RECEIVER PN 1808300

REF DES	DESCRIPTION	PART NO.	SIMILAR TO
	VR-3X Chassis Assembly		
	AC Input	1808301-1	MAC
	DC Input	1808301-2	MAC
	Meter Panel Assembly	1808225-1	MAC
	Local Oscillator Assembly	1808402-1	MAC
	Downconverter Assembly	1808390-1	MAC
	Cable Assembly Semi Rigid	1808597-1	MAC
	Power Supply		
	115 Vac Input	1808328-1	MAC
	230 Vac Input	1808328-2	MAC
	IF Amplifier Module Assembly	1808340-1	MAC
	Demodulator Module Assembly	1808336-1	MAC
	Cable Assembly	1801832-4	MAC
	Video Clamper Module Assembly	1808282-1	MAC
	Video Clamper/SC Processor Assy		
	6.8 MHz	1808482-1	MAC
	6.2 MHz	1808482-2	MAC
	Wire Harness Assy (Remote Control)	1808598-1	MAC
	Cable RF Converter Module Assy	1808607-99	MAC
	Cable Modulator Module Assembly	1808605-1	MAC
	Cable Assembly BNC-to-BNC	1802727-6	MAC
	Dual Audio Demodulator Assembly	1808398-99	MAC
	Panel, Front	1808385-2	MAC
	Cover, Top	1808386-1	MAC
	Accessory Kit		
	115 Vac	1809165-1	MAC
	230 Vac	1809166-1	MAC
	Instruction Manual	1808752-1	MAC

REF DES	DESCRIPTION	PART NO.	SIMILAR TO

VR-3X RECEIVER CHASSIS ASSEMBLY PN 1808301

Backplane PWB Assembly	1808458-1	MAC
Cable Assembly	1808387-24	MAC
AC Power Cord	188235	
Terminal Slip-On	188380-84	
Fuseholder	189300-4	
Cardguide	1808412	MAC
Mounting Bracket	1808243-1	MAC

REF DES	DESCRIPTION	PART NO.	SIMILAR TO
BACKPLANE PWB ASSEMBLY PN 1808458-1			
	Backplane PWB Assembly	1808457-1	MAC
	Fuse Clip	189300-1	
	CAPACITORS		
C1,C2	0.01, 1000V	189719-59	
C3	20 pF	189008-5	CM05ED200J03
	DIODES		
CR1,CR2	1N4000 (Optional)		
	TERMINALS		
E1,E2,E3	Disconnect Tab, PC Mount	188500-22	
	FUSES		
F1	3 AG, 0.2A	188200-24	
	CONNECTORS		
J1,J2,J3, J4,J5,J6	Connector	189759-53	EDAC 337-015-520-108
J7	12 Pin (Optional)	189350-67	Molex 1360
J8	6 Pin (Optional)189350-8	Molex 1261	
J9,J10,J11	BNC PC Mounted	1808520-1	MAC
J13	Barrier Strip, 3-Pin	189892-12	
J14			
J16	BNC PC Mounted	1808520-1	
J18	4-Pin	189396-49	Molex 21643
J19	9-Pin	189351-69	Molex
J20	10-Pin	189351-70	Molex
J21	8-Pin	189351-68	Molex
J22	6-Pin (Optional)	189351-66	Molex
J23	9-Pin	189350-20	Molex 1292
J24,J25	Barrier Strip	189892-12	Molex 8140-55-3
J26	Type F PC Mount	189396-48	
J27,J28	Type F PC Mount (Optional)	189396-48	
	RELAYS		
K1,K2	Relay (Optional)	189980-45	Sigma 191TE1C112G

REF DES	DESCRIPTION	PART NO.	SIMILAR TO
	RESISTORS		
All resistors are in ohms 1/4W 5% unless otherwise specified.			
R3,R4,R5, R6,R7,R8, R9,R10, R11,R12	75	189280	RC07GF750J
	CONNECTOR JACK		
TP1,TP2, TP3,TP4	Connector Jack	188500-21	

REF DES	DESCRIPTION	PART NO.	SIMILAR TO

RESONATOR AND TRANSISTOR MOUNTING ASSEMBLY PN 1808484-2

2 GHz Transistor	1808613-1	MAC
Capacitor, Feedthru	188212-13	Spectrum 547-1300-110-2P
Resonator	1808446-2	MAC
RF Choke	1802121-1	MAC

REF DES	DESCRIPTION	PART NO.	SIMILAR TO
METER PANEL ASSEMBLY PN 1808225			
	Meter	189198-37	MAC
	Panel, Meter	1808384-1	MAC
	LED, Red	189918-60	
	Resistor 2.4K, 1W, 5%	188538-12	
	Resistor 24K, 1/4W, 5%	189481-14	

LOCAL OSCILLATOR ASSEMBLY PN 1808402

REF DES	DESCRIPTION	PART NO.	SIMILAR TO
	Body Oscillator	1808401-1	MAC
	Resonator and Transistor Mtg. Assy	1808484-1	MAC
	AFC Bias PWB Assy	1808406-1	MAC
	Wiring Harness Assy	1808486-1	MAC
	Connector, SMA Female	1805148-1	American 2052-1201
	Bracket, Mounting	1808483-1	MAC

AFC BIAS BOARD ASSEMBLY PN 1808406

REF DES	DESCRIPTION	PART NO.	SIMILAR TO
	AFC Bias PWB	1808405-1	
	CAPACITORS		
	All capacitors are in microfarads unless otherwise specified.		
C1,C2	100, 20V (optional)	189719-4	Sprague 196D107X0020
C3	1000, 25V	189139-37	Siemens B4101D
C4	10, 25V	189719-9	
	TERMINALS		
E1, E2, E3, E4, E5, E6, E7	Standoff	188510-96	1385-2
	TRANSISTORS		
Q1	2N3906	189727	Motorola
	RESISTORS		
	All resistors are in 1/4W, 5% unless otherwise specified.		
R1	12K	189492	
R2	3.9K	189224	
R3	910	189200-19	
R4	1.5K	189236	
R5	150	189204	
R6	22, 1/2W	189243	
R7	Selected at test		
R8	Optional		
R9	Selected at test		
R10	Thermistor, Optional		

REF DES	DESCRIPTION	PART NO.	SIMILAR TO

POWER SUPPLY PWB ASSSEMBLY PN 1808328

	115 Vac	1808328-1	MAC
	230 Vac	1808328-2	MAC
	Power Supply PWB	1808329-1	MAC
	Wire Harness	1808413-1	MAC

CAPACITORS

All capacitors are in microfarads unless otherwise specified.

C1,C2	4700, 35V	189719-56	Hilton SWT35Z4700
C3,C4	1.5, 50V	189016	

DIODES

CR1,CR2	Diode Bridge, MDA201	189439-39	

INTEGRATED CIRCUITS

U1	Regulator A7815	189889-43	Fairchild
U2	Regulator, μ A7918UC	189889-6	Fairchild

DOWNCONVERTER ASSEMBLY PN 1808390-1

REF DES	DESCRIPTION	PART NO.	SIMILAR TO
	Housing	1808389-1	MAC
	Cover	1808393-1	MAC
	Cover	1808393-2	MAC
	IF Downconverter PWB Assembly	1808392-1	MAC
	RF Downconverter PWB Assembly	1808410-1	MAC
	Stripline Filter	1808501-1	MAC
	Stripline Filter Cover	1808408-1	MAC
	Ferrodisc Isolator	1808407-1	MAC
	Connector, SMA Rework	1805565-9	MAC
	Insulator	1808529-1	MAC
	Connector, Type N - Special	1808528-1	MAC
	Wire Harness Assembly	1808527-1	MAC
	Connector, Bulkhead Jack	188358-20	
	Capacitor, Feedthru, 1000 pF	188212-13	

REF DES	DESCRIPTION	PART NO.	SIMILAR TO
RF DOWNCONVERTER PWB ASSEMBLY PN 1808410-1			
	Microstrip Board	1808409-1	MAC
	CAPACITORS		
All capacitors are in microfarads unless otherwise specified.			
C1,C2	2.7 pF	189007-27	ATC 100A2R7BCX50
C3	Variable, 8 - 38 pF	189100-23	
C4	Variable, 2.5 - 10 pF	189100-19	
C5	1000 pF	189007-28	Murata GR40X5R102K
C6	Variable, 3.2 - 18 pF	189017-29	
C7	1000 pF	189007-28	Murata GR40X5R102K
C8	1000 pF	189007-14	Erie
C9,C10	1000 pF	189007-28	Murata GR40X5R102K
C11	47, 25V	189719-19	Hilton SWT25Z47
	DIODES		
CR1	Schottky Mixer	1808588-1	MAC
	CONNECTORS		
J1	Connector	188532-2	Sealectro 51-053-0000
	INDUCTORS		
L1,L2	3T, #26 AWG	1803852-48	MAC
	TRANSISTORS		
Q1	MA42141-511	189888-18	MA
Q2	2N2907A	187223-90	Motorola
	RESISTORS		
All resistors are in 1/4W 5% ohms unless otherwise specified.			
R1	180, 1/8W, 5%	189260-89	
R2	30, 1/8W, 5%	189262-11	
R3	180, 1/8W, 5%	189260-89	
R4	51, 1/8W, 5%	189260-20	
R5	150	189204	RC07GF151J
R6	3.9K	189224	RC07GF392J
R7	2.2K	189222	RC07GF222J
R8	820	189207	RC07GF821J
R9	12, 1/8W	189262-12	
R10,R11	430, 1/8W	189260-35	

REF DES	DESCRIPTION	PART NO.	SIMILAR TO

IF DOWNCONVERTER PWB ASSEMBLY PN 1808392-1

	Cable Assembly	1808526-4	MAC

CAPACITORS

All capacitors are in microfarads unless otherwise specified.

C1,C2,C3, C4,C5,C6, C7	Variable, 1.4 - 4 pF	189100-29	GKU4R000
C8	Variable,2.8 - 10 pF	189017-28	Matsushita ECV1ZW10P50
C9,C10,C11	1000 pF	189007-14	Erie 8121-100
C12,C13	12 pF	189085	CM05ED120J03
C14,C15,C16	1000 pF	189007-14	Erie 8121-100
C17	Variable, 2.8 - 10pF	189017-28	Matsushita ECV1ZW10P50
C18	10 pF	189116	CM05ED100J03
C19	75 pF	189017-78	CM05ED750J03
C20,C21	Variable, 3.2 - 18 pF	189017-29	Matsushita ECV1ZW20P50
C22	75 pF	189017-78	CM05ED750J03
C23	Variable, 2.8 - 10 pF	189017-28	Matsushita ECV1ZW10P50
C24	15 pF	189117	CM05ED150J03
C25	Variable, 2.8 - 10 pF	189017-28	Matsushita ECV1ZW10P50
C26	30 pF	189017-58	CM05ED300J03
C27	39 pF	189097	CM05ED390J03
C28	Variable, 3.2 - 18 pF	189017-29	Matsushita ECV1ZW20P50
C29	39 pF	189097	CM05ED390J03
C30,C31, C32,C33	1000 pF	189007-14	Erie 8121-00
C34	10, 25V	189719-9	Orange Drop
C35	2.2 pF, N750	189017-95	
C36	200 pF	189008-8	DM5
C37	1000 pF	189007-14	Erie 8121-100
C38	Variable, 1.5-4 pF	189100-29	GKUR000
C39	Variable, 2.8-10 pF	189107-28	ECV-1ZW10P50
C40	200 pF	189008-8	DM5
C41	1000 pF	189007-14	Erie 8121-100
C42	3 pF	189079	CM05ED030J03
C43	1000 pF	189007-14	Erie 8121-100
C46	6.8, 35V	189719-58	Sprague 196D685X9035KA1
C47	10, 25V	189719-9	Orange Drop
C48	Variable, 2.8 - 10 pF	189017-28	Matsushita ECV1ZW10P50

REF DES	DESCRIPTION	PART NO.	SIMILAR TO
	DIODES		
CR1	HP5082-2800	189424	Hewlett Packard
	TERMINALS		
E1,E2,E3, E4,E5,E6	Pin	188500-24	Concord Elec 10-876-2-03
	COILS		
All coils are in microhenries unless otherwise specified.			
L12	0.1	189169-63	Delvan 1025-94
L15,L16	Choke	189169-37	Ferroxcube VK200-10/3B
L17	0.27	189169-51	Delevan 1025-06
L18	0.1	189169-63	Delevan 1025-94
L19	0.15	189169-49	Delevan 1025-00
L20	0.1	189169-63	Delevan 1025-94
	RESISTORS		
All resistors are in ohm 1/4W 5% unless otherwise specified.			
R1,R3	390	189180	RC07GF391J
R4	39	189480	RC07GF390J
R5	75	189280	RC07GF750J
R6	51	189238-38	RC07GF510J
R7	390	189180	RC07GF391J
R8	12	189475	RC07GF120J
R9,R10	120	189203	RC07GF121J
R11	10	189231	RC07GF100J
R12	10K	189227	RC07GF103J
	INTEGRATED CIRCUITS		
U1	Regulator, A7815UC	189889-43	Fairchild
U2,U3,U4	MWA 120	189889-40	
U5	Mixer	189889-46	Mini Circuits Lab TFM-2
	SHORTING PLUG		
W1,W2	Shorting Plug	188500-23	SAE RSR2620-2BL

REF DES	DESCRIPTION	PART NO.	SIMILAR TO
IF AMPLIFIER PWB ASSEMBLY PN 1808340-1			
	IF Amplifier PWB	1808339-1	MAC
	Cable Assembly	1808411-5	MAC
	CAPACITORS		
All capacitors are in microfarads unless otherwise specified.			
C1	Variable, 2.8 - 10 pF	189017-28	Matsushita ECV1ZW10P50
C2,C3,C4, C5,C6,C7, C8,C9	0.001	189007-14	Erie 8121-100
C10	39 pF	189097	CM05ED390J03
C11	Variable, 3.2 - 18 pF	189017-29	Matsushita ECV1Z20P50
C12	0.01	189014	Erie
C13,C14, C15,C16	0.001	189007-14	Erie 8121-100
C17	39 pF	189097	CM05ED390J03
C18	0.01	189014	Erie
C19,C20,C21	0.001	189007-14	Erie 8121-100
C22	0.01	189014	Erie
C23,C24	0.001	189007-14	Erie 8121-100
C25	10, 25V	189719-9	Orange Drop
C26,C27,C28	0.001	189007-14	Erie 8121-100
C29,C30	Optional - Selected at Final Test		
C31	0.001	189007-14	Erie 8121-100
C32,C33	0.01	189014	Erie
C34,C35	10, 25V	189719-9	Orange Drop
C36	100, 20V	189719-4	Sprague 196D
C37	12 pF	189085	CM05ED120J03

REF DES	DESCRIPTION	PART NO.	SIMILAR TO
C38,C39,C40, C41,C42,C43, C44,C45,C46	0.001	189007-14	Erie 8121-100
C47	0.01	189014	Erie
C48,C49	10, 25V	189719-9	Orange Drop
C50	0.01	189014	Erie
C51	240 pF	189077	CM05ED241J03
C52,C53,C54, C55,C56,C57	0.001	189007-14	Erie 8121-100
C58	10, 25V	189719-9	Orange Drop
C59,C60	0.001	189007-14	Erie 8121-100
C61,C62,C63	10, 25V	189719-9	Orange Drop
C64	30 pF	189017-58	CM05ED300J03
C65,C66	0.001	189007-14	Erie 8121-100
C67	10, 25V	189719-9	Orange Drop
C68,C69	0.001	189007-14	Erie 8121-100
C71	0.01	189014	Erie
C72	0.001	189007-14	Erie 8121-100
C73	10, 25V	189719-9	Orange Drop
C75,C76	0.001	189007-14	Erie 8121-100
C80	200 pF	18008-76	CM05ED201J03
C81	Optional - Selected at Final Test		
C82	0.001	189007-14	Erie 8121-100
	DIODES		
CR1	1N914	189405	GE
CR2,CR3	1N830	189404	
CR4,CR5, CR6	1N914	189405	GE

REF DES	DESCRIPTION	PART NO.	SIMILAR TO
CR7	ND2619	189439-32	NEC
CR9	1N914	189405	GE
	TERMINALS		
E1,E2,E3 E4,E5,E6	Jumper Pins	188500-24	Concord Elec 10-876-2-03
	CONNECTORS		
J2	Connector	188358-19	
	COILS		
All coils are in microhenries unless otherwise specified.			
L1,L2,L3,L4, L5,L6,L7	Choke	189169-37	Ferroxcube VK200-10/3B
L8	0.33	189160	Delevan 1537
L9,L10, L11,L12	Choke	189169-37	Ferroxcube VK200-10/3B
L13	22	189161-1	Delevan 1537
L14,L15,L16	Choke	189169-37	Ferroxcube VK200-10/3B
	TRANSISTORS		
Q1,Q2, Q3,Q4	MPS918	189774	Motorola
Q5	2SC1424	187223-41	
Q6	2SC1426	187223-45	
	RESISTORS		
All resistors are in ohms 1/4W 5% unless otherwise specified.			
R1	56	189232	RC07GF560J
R2	15	189239	RC07GF150J
R3	51	189238-38	RC07GF510J
R4,R5	15	189239	RC07GF150J
R6	2K	189488	RC07GF202J
R7	1K	189220	RC07GF102J
R8	1.8K	188248	RC07GF182J
R9	510	189481-19	RC07GF511J
R10	2K	189488	RC07GF202J

REF DES	DESCRIPTION	PART NO.	SIMILAR TO
R11	15	189239	RC07GF150J
R12	1K	189220	RC07GF101J
R13	1.5K	189236	RC07GF152J
R14	7.5K	189481-44	RC07GF752J
R15	2K	189488	RC07GF202J
R16	Potentiometer 5K	188453-84	Bourns 3299P-1-502
R17	4.3K	189481-39	RC07GF432J
R18	100K	189278	RC07GF104J
R19	5.1K	189491	RC07GF512J
R20	510	189481-19	RC07GF511J
R21	430	189238-31	RC07GF431J
R22	820	189207	RC07GF821J
R23	5.1K	189491	RC07GF512J
R24	560	189235	RC07GF561J
R25	27K	188078	RC07GF273J
R26	9.1K	189200-12	RC07GF912J
R27	4.7K	189225	RC07GF472J
R28	4.3K	189481-44	RC07GF432J
R29	8.2K	189237	RC07GF822J
R30	27K	188078	RC07GF273J
R31	10	189231	RC07GF100J
R32	820	189207	RC07GF821J
R33	Potentiometer 500	188453-36	Helitrim 62P
R34,R35	1K	189220	RC07GF102J
R36	820	189207	RC07GF821J
R37	1K	189220	RC07GF102J
R38	47	189201	RC07GF470J
R39,R40, R41,R42	1K	189220	RC07GF102J
R43	560	189235	RC07GF561J
R44,R45,R46, R47,R48	1K	189220	RC07GF102J
R49	82	189238-44	RC07GF821J
R50	2.7K	189181	RC07GF272J
R51	24	189238-20	RC07GF240J
R52	330	189205	RC07GF331J
R53	270	189485	RC07GF271J
R54	75	189280	RC07GF750J
R55	36	189479	RC07GF360J
R56	56	189232	RC07GF560J
R57	47	189201	RC07GF470J
R58	430, 1/2W	188538-25	RC20GF431J

REF DES	DESCRIPTION	PART NO.	SIMILAR TO
R59	35, 3W	188539-86	
R60	1.5K	189236	RC07GF152J
R61	1.3K	189200-26	RC07GF132J
R62	15K	189275	RC07GF153J
R63	2K	189488	RC07GF202J
R64	10K	189227	RC07GF103J
R65,R66,R67	510	189481-19	RC07GF511J
R68	100	189202	RC07GF101J
R69	20	189477	RC07GF200J
R70,R71,R72	510	189481-19	RC07GF511J
R73	10K	189227	RC07GF103J
R74,R75,R76	10	189231	RC07GF100J
R77	47	189201	RC07GF470J
R78	1.2K	189221	RC07GF122J
	SWITCHES		
S1	Switch	189220-63	Alco MSS-1200R
	TOROID		
T1,T2,T3	Toroid	1803380-31	MAC
	INTEGRATED CIRCUITS		
U1,U2,U3	MWA120	189889-40	Motorola
U4	MC10102	189976-33	Motorola
U5	747	189976-21	
U6	MC10131	189976-34	Motorola
U7,U8	MC10116	189976-37	Motorola
U9	CA3100	189889-2	RCA
U10	MWA120	189889-40	Motorola
U11	7905	189889-41	
	SHORTING PLUG		
W1,W2	Shorting Plug	188500-23	SAE RSR2620-2BL

REF DES	DESCRIPTION	PART NO.	SIMILAR TO
DEMODULATOR PWB ASSEMBLY PN 1808336-1			
	Demodulator PWB	1808335-1	MAC
	CAPACITORS		
All capacitors are in microfarads unless otherwise specified.			
C1	Variable, 2.8 - 10 pF	189017-28	Matsushita ECV1ZW20P10
C2,C3,C4,C5	0.01	189014	Erie
C6A	120 pF	189017-12	CM05ED121J03
C6B	15 pF	189117	CM05ED150J03
C7	0.001, 200V	187210	Vitramon CK05BX102K
C8	10, 25V	189719-9	Orange Drop
C9A	120 pF	189017-12	CM05ED121J03
C9B	15 pF	189117	CM05ED150J03
C10A	100 pF	189086	CM05ED101J03
C10B	Optional		CM05
C11A	100 pF	189086	CM05ED101J03
C11B	Optional		CM05
C12	100, 20V	189719-4	Sprague 196D107X9020TE4
C13,C14	0.01	189014	Erie
C15	100, 20V	189719-4	Sprague 196D107X9020TE4
C16	10, 25V	189719-9	Orange Drop
C17	0.01	189014	Erie
C18	10, 25V	189719-9	Orange Drop
C19	0.01	189014	Erie
C20	100, 20V	189719-4	Sprague 196D107X9020TE4
C21	910 pF	189017-5	CD15
C22	2200, 16V	189139-36	
C23	5 pF	189078	CM05ED050J03
C24,C25	Optional		CM05
C26,C27	0.01	1889014	Erie
C28,C29	100, 20V	189719-4	Sprague 196D107X9020TE4
C30	0.01	189014	Erie
C31	1000 pF	189007-14	Erie 8121-100
C32,C33,C34, C35,C36	1.5, 50V	189719-57	Sprague 196D155X9025KA1

REF DES	DESCRIPTION	PART NO.	SIMILAR TO
C37	51 pF	189098	CM05ED510J03
C38	120 pF	189017-12	CM05ED121J03
C39	0.05	188212-12	Erie
C40	100, 20V	189719-4	Sprague 196D107X9020TE4
C41,C42	1.5, 50V	189719-57	Sprague 196D155X9025KA1
C43, C44	0.47 100, 20V	189719-37 189719-4	Erie 8131-050-651-474 Sprague 196D107X9020TE4
C45,C46	0.01	189014	Erie
C47	0.001, 200V	187210	Vitramon CK05BX102K
C48,C49	10, 25V	189719-9	Orange Drop
C50	0.001, 200V	187210	Vitramon CK05BX102K
C51	10, 25V	189719-9	Orange Drop
C52,C53	0.01	189014	Erie
C54	100, 20V	189719-4	Sprague 196D107X9020TE4
	DIODES		
CR1,CR2, CR3,CR4 CR5	1N914A	189405	GE
	TERMINALS		
E1,E2,E3 E4,E5,E6	Pin	188500-24	Concord Elec 10-876-2-03
	CONNECTORS		
J1	Connector	188358-19	
	COILS		
All coils are in microhenries unless otherwise specified.			
L1	0.68	189162	
L2,L3	8.2	187264	
L4,L5	10	187265	Delevan
L6,L7	3.9	189157	
L8	Choke	189169-37	Ferroxcube VK200-10/3B

REF DES	DESCRIPTION	PART NO.	SIMILAR TO
	TRANSISTORS		
Q1,Q2,Q3, Q4,Q5	2N3904	189700	Motorola
Q6	2N3906	189727	Motorola
Q7	2N2219	187223-21	
Q8	2N2905	189728-12	
Q9,Q10	2N3904	189700	Motorola
	RESISTORS		
All resistors are in ohms 1/4W 5% unless otherwise specified.			
R1	270	189485	RC07GF271J
R2	47	189201	RC07GF470J
R3	270	189485	RC07GF271J
R4	360	189200-11	RC07GF361J
R5,R6,R7	1K	189220	RC07GF102J
R8	560	189235	RC07GF561J
R9	1K	189220	RC07GF102J
R10	510	189481-19	RC07GF511J
R11	270	189485	RC07GF271J
R12	1K	189220	RC07GF102J
R13,R14	510	189481-19	RC07GF511J
R15	1K	189220	RC07GF102J
R16	510	189481-19	RC07GF511J
R17,R18	270	189485	RC07GF271J
R19,R20,R21	5.1K	189491	RC07GF512J
R22	100	189202	RC07GF101J
R23	5.1K	189491	RC07GF511J
R24	1.3K	189200-26	RC07GF132J
R25	510	189481-19	RC07GF511J
R26	Potentiometer 500	188453-36	Helitrim 62P
R27	150	189204	RC07GF151J
R28	Potentiometer 100	188453-33	Helitrim 62P
R29	1.2K	189221	RC07GF122J
R30	Potentiometer 500	188453-39	Helitrim 62P
R31	360	189200-11	RC07GF361J
R32	100	189202	RC07GF101J
R33,R34	200	189484	RC07GF201J

REF DES	DESCRIPTION	PART NO.	SIMILAR TO
R35	Potentiometer 100	188453-33	Helitrim 62P
R36	10K	189227	RC07GF103J
R37	160	189200-13	RC07GF161J
R38	100	189202	RC07GF101J
R39	1K	189220	RC07GF102J
R40	100	189202	RC07GF101J
R41	Optional		
R42	62	189481-18	RC07GF620J
R43	2.7K	189181	RC07GF272J
R44,R45	20	189477	RC07GF200J
R46,R47	1K	189220	RC07GF102J
R48	510	189481-19	RC07GF511J
R49,R50	1.5K	189236	RC07GF152J
R51	110	189483	RC07GF111J
R52,R53	100	189202	RC07GF101J
R54,R55	10K	189227	RC07GF103J
R56,R57	2M	189200-21	RC07GF205J
R58	100	189202	RC07GF101J
R59,R60	10K	189227	RC07GF103J
R61	1K	189220	RC07GF102J
R62	10M	189481-51	RC07GF106J
R63	1M	189238-30	RC07GF105J
R64,R65	5.1K	189491	RC07GF512J
R66	20	189477	RC07GF220J
R67,R68	1K	189220	RC07GF102J
R69	10K	189227	RC07GF103J
R70	20K	189200-14	RC07GF203J
R71	2K	189488	RC07GF202J
R72	33, 5W	188539-85	Clarostat VC5E

REF DES	DESCRIPTION	PART NO.	SIMILAR TO
	TOROID COILS		
T1	Toroid	1803380-34	MAC
	TEST JACKS		
TP1	White	188500-19	H H Smith 328-101
TP2	Black	188500-20	H H Smith 328-103
	INTEGRATED CIRCUITS		
U1	MC10116	189976-37	Motorola
U2	MC10131	189976-34	Motorola
U3,U4	MC10102	189976-33	Motorola
U5	A733	189976-20	Fairchild
U6	MC10178	189976-90	Motorola
U7	MC14024 or CD4024	189976-87	Motorola or RCA
U8	MC14568	189976-91	Motorola
U9	CD4060	189889-9	RCA
U10	LF356	189976-93	National Semiconductor
U11	A741	189976-12	Fairchild
U12	A78M12	189889-25	Fairchild
U13	A7905	189889-41	Fairchild
	SHORTING PLUGS		
W1,W2	Shorting Plug	188500-23	SAE R5R2620-2BL
	CRYSTALS		
Y1	1.4 MHz	1806502-1	MAC

REF DES	DESCRIPTION	PART NO.	SIMILAR TO

VIDEO CLAMPER AMPLIFIER PWB ASSEMBLY PN 1808282-1

CAPACITORS

All capacitors are in microfarads unless otherwise specified.

C1	180 pF	189123	CM05ED181J03
C2	200 pF	189008-76	CM05ED201J03
C3	62 pF, 1%	189008-71	CM05ED620J03
C4	82 pF, 1%	189008-72	CM05ED820J03
C5	270 pF	189141	CM05ED271J03
C6	330 pF	189089	CM05ED331J03
C7	470 pF, 1%	189008-29	CM05ED471J03
C8	47 pF, 1%	189008-79	CM05ED470J03
C9,C10	100 pF	189086	CM05ED101J03
C11	510 pF	189017-51	CM05ED511J03
C12	680 pF, 1%	189017-3	CM05ED681J03
C14	5 pF	189078	CM05ED050J03
C15	0.0022	189017-44	Erie 8131-026X5R0222K
C16	0.01	189014	Erie
C17	Optional - Selected at Final Test		
C18	330 pF	189089	CM05ED332J03
C19	470 pF, 1%	189008-29	CM05ED471J03
C20	10, 25V	189719-9	Orange Drop
C21	100, 20V	189719-4	Sprague 196D107X9020TE4
C22	0.1	188212-14	CK06
C23	100, 20V	189719-4	Sprague 196D107X9020TE4
C24	0.1	188212-14	CK06
C25	10, 25V	189719-9	Orange Drop
C26	8.2, 15V	189765	Kemet K8R2W15
C27	1.5, 50V	189016	Kemet K1R5W50
C28	200 pF	189008-76	CM05ED201J03
C29,C30, C31,C32	10, 25V	189719-9	Orange Drop
C33	220 pF	189017-61	CM05ED221J03

DIODES

CR1,CR2	1N914	189405	GE

REF DES	DESCRIPTION	PART NO.	SIMILAR TO
	TERMINALS		
E1,E2,E3,E4, E5,E6,E7,E8, E9,E10,E11	Pin	188500-23	Concord Elec 10-876-2-03
	COILS		
All coils are in microhenries unless otherwise specified.			
L1	2.49	189161-46	Cambion 7106-12
L2	1.34	189161-31	Cambion 7106-11
L3	6.75	1803380-32	MAC
	TRANSISTORS		
Q1,Q2	2N3904	189700	Motorola
Q3	2N3906	189727	Motorola
Q4	2N2219	187223-21	
Q5	2N2905	189728-12	
Q6	2N3904	189700	Motorola
Q7	2N3906	189727	Motorola
Q8	2N5457	189223-71	
Q9	2N3904	189700	Motorola
	RESISTORS		
All resistors are in ohms 1/4W 5% unless otherwise specified.			
R1	75	189280	RC07GF750J
R2	220	189233	RC07GF221J
R3	56	189232	RC07GF560J
R4	220	189233	RC07GF221J
R5	300	189486	RC07GF301J
R6	Potentiometer 100	188453-34	Helitrim 62P
R7	150	189204	RC07GF151J
R8	1K	189220	RC07GF102J
R9	360	189200-11	RC07GF361J
R10	200	189484	RC07GF201J
R11	100	189202	RC07GF101J
R12	Potentiometer 100	188453-33	Helitrim 62P
R13	200	189484	RC07GF201J
R14	4.3K	189481-39	RC07GF432J
R15	62	189481-18	RC07GF620J
R16	1K	189220	RC07GF102J
R17,R18	20	189477	RC07GF200J

REF DES	DESCRIPTION	PART NO.	SIMILAR TO
R19	68	189482	RC07GF680J
R20	2.7K	189181	RC07GF272J
R21	100	189202	RC07GF101J
R22	15K	189275	RC07GF153J
R23	12K	189492	RC07GF123J
R24	10M	189481-51	RC07GF106J
R25	100K	189278	RC07GF104J
R26	5.1K	189491	RC07GF512J
R27	24K	189481-14	RC07GF243J
R28	2.4K	189489	RC07GF242J
R29	2.2K	189222	RC07GF222J
R30	3.6K	189200-15	RC07GF362J
R31	220	189233	RC07GF221J
R32	1K	189220	RC07GF102J
R33	4.3K	189481-39	RC07GF432J
R34	1K	189220	RC07GF102J
R35,R36	3.9K	189224	RC07GF392J
R37	1K	189220	RC07GF102J
R38	8.2K	189237	RC07GF822
R39	6.2K	189200-5	RC07GF622J
R40	10K	189227	RC07GF103J
R41,R42	1K	189220	RC07GF102J
R44	1.5K	189236	RC07GF152J
R45	1.2K	189221	RC07GF122J
R46	100K	189278	RC07GF104J
R47	3.3K	189233	RC07GF332J
R48	1.5K	189236	RC07GF152J
R49	3.3K	189223	RC07GF332J
R50	620	189200-10	RC07GF621J
R100	1K	189220	RC07GF101J
R101	Optional - Selected at Final Test		
	INTEGRATED CIRCUITS		
U1	LF256	189976-96	National
U2	733	189976-20	Fairchild
U3	CA3120E	189889-42	RCA
U4	79M06 (TO-220)	189889-5	
U5	78M12UC (TO-220)	189889-25	
	SHORTING PLUGS		
W1,W2,W4	Shorting Plug	188500-23	R5R2-620-2BL

REF DES	DESCRIPTION	PART NO.	SIMILAR TO

VIDEO CLAMPER/SUBCARRIER PROCESSOR PWB PN 1808482

	6.8 MHz	1808482-1	MAC
	6.2 MHz	1808482-2	MAC

Note: when two values are listed for a component, the first value is used in the -1 assembly and the second value is used ine the -2 assembly.

CAPACITORS

All capacitors are in microfarads unless otherwise specified.

C1,C2	1200 pF	189008-84	CM05ED122J03
C3	180 pF	189123	CM05ED181J03
C4	200 pF	189008-76	CM05ED201J03
C5	62 pF, 1%	189008-71	CM05ED620J03
C6	82 pF, 1%	189008-72	CM05ED820J03
C7	270 pF	189141	CM05ED271J03
C8	470 pF	189008-29	CM05ED471J03
C9	47 pF	189008-79	CM05ED470J03
C10	330 pF	189089	CM05ED331J03
C11	100 pF	189086	CM05ED101J03
C12	110 pF	18008-75	CM05ED111J03
C13	1200 pF	189008-84	CM05ED122J03
C14	Optional		
C15	5 pF	189078	CM05ED050J03
C16	0.0022	189017-44	Erie 8131-026X5R0222K
C17	0.01	189014	Erie
C18	Optional		
C19	470 pF	189008-29	CM05ED471J03
C20	330 pF	189089	CM05ED331J03
C21	200 pF	189008-76	CM05ED201J03
C22	1.5, 50V	189016	Kemet K1R5W50
C23	8.2, 15V	189765	Kemet K8R2W15
C24	10, 25V	189719-9	Orange Drop
C25	100	189719-4	Orange Drop
C26,C27	0.1	188212-14	CK06
C28	100	189719-4	Orange Drop
C29	10, 25V	189719-9	Orange Drop
C30	300 pF	189017-52	CM05ED301J03
	270 pF	189141	CM05ED271J03

REF DES	DESCRIPTION	PART NO.	SIMILAR TO
C31	130 pF	189017-22	CM05ED131J03
	120 pF	189017-12	CM05ED121J03
C32	20 pF	189008-5	CM05ED020J03
C33	Variable, 3.2-18 pF	189017-29	Matsushita ECV1Z20P
C34	Variable, 3.2 - 18 pF	189017-29	Matsushita ECV1Z20P
	Variable, 2.8 - 10 pF	189017-28	Matsushita ECV1Z10P
C35	Variable, 3.2 - 18 pF	189017-29	Matsushita ECV1Z20P
	Variable 2.8 - 10 pF	189017-28	Matsushita ECV1Z10P
C36	100 pF	189086	CM05ED100J03
C37	Variable, 3.2 - 18 pF	189017-29	Matsushita ECV1Z20P
	Variable, 2.8 - 10 pF	189017-28	Matsushita ECV1Z10P
C38	20 pF	189008-5	CM05ED200J03
C39	Variable, 3.2 - 18 pF	189017-29	Matsushita ECV1Z20P
C40	150 pF	189008-74	CM05ED151J03
	120 pF	189017-12	CM05ED121J03
C41	200 pF	189008-76	CM05ED201J03
	430 pF	189017-80	CM05ED431J03
C42	0.01	189014	Erie
C43	10	189719-9	Orange Drop
C44	0.01	189014	Erie
C45	62 pF	189008-71	CM05ED620J03
C46	360 pF	189088	CM05ED361J03
C47	Variable, 3.2 - 18 pF	189017-29	Matsushita ECV1Z20P
C48	0.01	189014	Erie
C49	0.1	188212-14	CK06
C50	18 pF	189008-36	CM05ED180J03
C51	100 pF	189086	CM05ED101J03
C52	Variable 2.8 - 10 pF	189017-28	Matsushita ECV1Z10P
C53,C54	0.01	189014	Erie
C55	110 pF	189008-75	CM05ED111J03
C56,C57,C58	Variable, 3.2 - 18 pF	189017-29	Matsushita ECV1Z20P
C59	10	189719-9	Orange Drop
C60	110 pF	189008-75	CM05ED111J03

REF DES	DESCRIPTION	PART NO.	SIMILAR TO
C61,C62,C63, C64	0.01	189014	Erie
C65,C66	10	189719-9	Orange Drop
C67	0.1	188212-14	CK06
C68	10	189719-9	Orange Drop
C69	0.1	188212-14	CK06
C70,C71,C72, C73	10	189719-9	Orange Drop
C74	220 pF	189017-61	CM05ED221J03
C75	10	189719-9	Orange Drop
C76	0.01	189014	Erie

DIODES

CR1,CR2	1N914	189405	GE

TERMINALS

E1,E2,E3,E4, E5,E6,E7,E8, E9,E10,E11,	Pin E12,E13,E14	188500-24	Concord Elec 10-876-2-03

COILS

All coils are in microhenries unless otherwise specified.

L1	0.4	189161-36	Cambion 7106-08
L2	2.49	189161-46	Cambion 7106-12
L3	1.34	189161-31	Cambion 7106-11
L4	6.75	1803380-32	MAC
L5,L6,L7	4.7	187262	Delevan 1537-28
	5.6	189169-1	Delevan 1537-30
L8	1	187255	Delevan 1537-12
L9	10	187265	Delevan 1537-36
L10,L11	1	187255	Delevan 1537-12

TRANSISTORS

Q1,Q2	2N3904	189700	Motorola

Q3	2N3906	189727	Motorola
Q4	2N2219	187223-21	
U5	2N2905	189728-12	
U6	2N3906	189727	Motorola
Q7	2N3904	189700	Motorola
Q8	2N5457	187223-71	

REF DES	DESCRIPTION	PART NO.	SIMILAR TO
Q9,Q10,Q11	2N3904	189700	Motorola
Q12	40823	187223-72	RCA
Q13,Q14,Q15, Q16	2N3904	189700	Motorola

RESISTORS

All resistors are in ohms 1/4W 5% unless otherwise specified.

R1	75	189280	RC07GF750J
R2	430	189238-31	RC07GF431J
R3	27	189200	RC07GF270J
R4,R5,R6	430	189238-31	RC07GF431J
R7	620	189200-10	RC07GF621J
R8	300	189486	RC07GF301J
R9	Potentiometer 100	188453-34	Helitrim 62P
R10	150	189204	RC07GF151J
R11	1K	189220	RC07GF102J
R12	360	189200-11	RC07GF361J
R13	200	189484	RC07GF201J
R14	100	189202	RC07GF101J
R15	200	189484	RC07GF201J
R16	Potentiometer 100	188453-33	Helitrim 62P
R17	62	189481-18	RC07GF620J
R18	20	189477	RC07GF200J
R19	10M	189481-51	RC07GF106J
R20	12K	189492	RC07GF123J
R21	15K	189275	RC07GF153J
R22	4.3K	189481-39	RC07GF432J
R23	Optional		
R24	Potentiometer 100	188453-33	Helitrim
R25	68	189482	RC07GF680J
R26	2.7K	189181	RC07GF272J
R27	1K	189220	RC07GF102J
R28	20	189477	RC07GF200J
R29	1K	189220	RC07GF102J
R30	2.4K	189489	RC07GF242J
R31	2.2K	189222	RC07GF222J
R32	3.6K	189200-15	RC07GF362J
R33	220	189233	RC07GF221J
R34	1K	189220	RC07GF102J

REF DES	DESCRIPTION	PART NO.	SIMILAR TO
R35	24K	189481-14	RC07GF243J
R36	5.1K	189491	RC07GF512J
R37	3.3K	189223	RC07GF332J
R38	1.5K	189236	RC07GF152J
R40	3.3K	189223	RC07GF332J
R41	100K	189278	RC07GF104
R42	1K	189220	RC07GF102J
R43	10K	189227	RC07GF102J
R44	1K	189220	RC07GF102J
R45	1.2K	189221	RC07GF122J
R46	8.2K	189237	RC07GF822
R47	1K	189220	RC07GF102J
R48	1.5K	189236	RC07GF152J
R49	6.2K	189200-5	RC07GF622J
R50	3.9K	189224	RC07GF392J
R51	1K	189220	RC07GF102J
R52	4.3K	180481-39	RC07GF432J
R53	3.9K	189224	RC07GF392J
R54	510	189481-19	RC07GF511J
R55	9.1K	189200-12	RC07GF912J
R56	3K	189490	RC07GF302J
R57	510	189481-19	RC07GF511J
R58	30	189238-25	RC07GF300J
R59	300	189486	RC07GF301J
R60	1K	189220	RC07GF102J
R61	39	189480	RC07GF390J
R62	150	189204	RC07GF151J
R63	39	189480	RC07GF390J
R64	150	189204	RC07GF151J
R65	47K	189229	RC07GF473J
R66	9.1K	189200-12	RC07GF912J
R67	100K	189278	RC07GF104J
R68	75	189280	RC07GF750J
R69	13K	189481-42	RC07GF133J
R70	1.5K	189236	RC07GF152J
R71	2.4K	189489	RC07GF242J
R72	51	189238-38	RC07GF510J
R73	150	189204	RC07GF151J
R74	510	189481-19	RC07GF511J
R75	47	189201	RC07GF470J
R76	300	189486	RC07GF301J
R77	820	1889207	RC07GF821J

REF DES	DESCRIPTION	PART NO.	SIMILAR TO
R78	10K	189227	RC07GF103J
R79	3K	189490	RC07GF302J
R80	270	189485	RC07GF271J
R81	750	189487	RC07GF751J
R82	1K	189220	RC07GF102J
R83,R84	910	189200-19	RC07GF911J
R85	6.2K	189200-5	RC07GF622J
R86	Potentiometer 1K	188453-26	Helitrim 62P
R87	5.1K	189491	RC07GF512J
R88	1K	189220	RC07GF102J
R89	27	189200	RC07GF270J
R90	100K	189278	RC07GF104J
R91	56	189232	RC07GF560J
	TEST POINTS		
TP1,TP2	Test Point	188510-96	1385-2
	INTEGRATED CIRCUITS		
U1	16-Pin DIP, CA3120E	189889-42	RCA
U2	10-Pin (TO-5), A733	189976-20	Fairchild
U3	8-Pin (TO-5), LF356	189976-93	National
U4	Mixer	189889-50	Mini Circuits Lab SBL-1
U5	14-Pin, DIP, 74LS197	189976-88	
U6	Regulator 78M05	189976-94	
U7	78M12UC (TO-220)	189889-25	
U8	Regulator, 78M06 (TO-220)	189889-5	
U9,U10	Filter, 4.5 MB	189889-51	Murata SFE
	SHORTING PLUGS		
W1,W2,W3, W4,W5	Shorting Plug	188500-23	SAE S2620-2BL
	CRYSTALS		
Y1	20.30000 MHz	1808669-1	MAC
	19.70000 MHz	1808669-2	MAC

REF DES	DESCRIPTION	PART NO.	SIMILAR TO

AUDIO DEMODULATOR PN 1808398

Single Audio Demodulator*		
5.8 MHz	1808398-5	MAC
6.2 MHz	1808398-3	MAC
6.8 MHz	1808398-1	MAC
7.4 MHz	1808398-6	MAC
7.5 MHz	1808398-4	MAC

*These frequencies are Channel "A" on the Audio Demodulator Assembly. Channel "B" is not used.

Dual Audio Demodulator**		
6.2 and 6.8 MHz	1808398-2	MAC

**Channel "A" is 6.2 MHz and Channel "B" is 6.8 MHz.

NOTE

Components common to all assemblies, 1809398-1 through 1808398-6, are listed first. Channel A components bear 100 series reference designations (i.e. C101) and Channel B components bear 200 series reference designations (i.e. C201). Common components for Channel A and Channel B are identical; for example L101 is identical to L201, C109 is identical to C209, and so forth. Components not bearing 100 or 200 series reference designations are used once on each assembly.

REF DES	DESCRIPTION	PART NO.	SIMILAR TO

DUAL AUDIO DEMODULATOR PWB PN 1808398

CAPACITORS

All capacitors are in microfarads unless otherwise specified.

C25,C26	10,25V	189719-9	Hilton SWT25Z10
C27	1.5, 50V	189719-57	Hilton SWT50Z150
C109, C209	0.001	189007-14	Erie 8121-A112-X5F-102K
C110, C210	0.01	189014	Sprague RMC
C111, C211 C112, C212	100 pF	189086	Erie
C118, C218	0.01	189014	Sprague RMC
C119, C219	0.01, 50V, 1%	188212-87	287P1031R5A3
C120, C220	6.8, 35V	189719-58	Sprague 196D685X9035KA1

COILS

All coils are in microhenries unless otherwise specified.

L101,L102, L103	3.76 - 5.64	189161-75	Caddell Burns CB6709-14
L104,L105	8 - 12	189161-42	CTC 556-7106-16

TRANSISTORS

Q4,Q101	2N3904	189700	Motorola
Q102	2N3906	189727	Motorola
Q103	2N3904	189700	Motorola

RESISTORS

All resistors are in ohms 1/4W 5% unless otherwise specified.

R104	3K	189490	RC07GF301J
R107	10	189231	RC07GF100J
R108	330	189205	RC07GF331J

REF DES	DESCRIPTION	PART NO.	SIMILAR TO
R111	10	189231	RC07GF100J
R112	7.15K	189256-90	RN55D7R15F
R113	Potentiometer 1K	188453-25	Helitrim 62P
R114	1K, 1%	187460	RN55D1001F
R115	10K, 1%	189326	RN55D100RF
R116	46.4K, 1%/	189327-24	RN55D45R4F
R117	10K, 1%	189326	RN55D100RF
R118	56.2K, 1%	189319	RN55D56R2F
R119	10K, 1%	189326	RN55D1001F
R120,R121	301, 1%	189327-42	RN55D3010F
R124	1.5K, 1%	189256-16	RN55D1R50F
R125	Potentiometer 1K	188453-26	Helitrim 62P
R126	3.32K, 1%	189481-24	RN55D3R32F

INTEGRATED CIRCUITS

U3	A78M12UC	189889-25	Fairchild
U101	MC1375P	189976-71	Motorola
U102	MC1458	189976-22	Motorola

REF DES	DESCRIPTION	PART NO.	SIMILAR TO

6.8 MHz AUDIO DEMODULATOR PN 1808398-1

CAPACITORS

All capacitors are in picofarads unless otherwise specified.

C101	110 pF	189008-75	CM05ED111J03
C102	22 pF, N750	189017-89	Erie 831-000-U2JO-220J
C103	2.2 pF	189017-14	CC220CK2R2C
C104	110 pF	189008-75	CM05ED111J03
C105	22 pF, N750	189017-89	Erie 831-000-U2JO-220J
C106	3.9 pF	189017-84	Erie 301-611-C0K-399C
C107	110 pF	189008-75	CM05ED111J03
C108	22 pF, N750	189017-89	Erie 831-000-U2JO-220J
C113	10 pF	189116	CM05ED100J03
C114,C115	51 pF	189098	CM05ED510J03
C116,C117	2 pF	189017-20	CM05ED020J03

RESISTORS

All resistors are in ohms 1/4W 5% unless otherwise specified.

R101	9.1K	189200-12	RC07GF912J03
R102	62K	189238-50	RC07GF623J03
R103	270K	189200-22	RC07GF274J03
R105	2.4K	189489	RC07GF242J03
R106	560	189235	RC07GF561J03
R109,R110	9.1K	189200-12	RC07GF912J03

6.2 MHz AND 6.8 MHz AUDIO DEMODULATOR PN 1808398-2

CAPACITORS

All capacitors are in microfarads unless otherwise specified.

REF DES	DESCRIPTION	PART NO.	SIMILAR TO
C101	110 pF	189008-75	CM05ED111J03
C102	22 pF N750	189017-89	ERIE 831-000-U2J0-220J
C103	2.2 pF	189017-14	CC220CK2R2C
C104	110 pF	189008-75	CM05ED111J03
C105	22 pF N750	189017-34	Erie 831-000-U2J0-220J
C106	3.9 pF	189017-84	Erie 301-611-COK-399C
C107	110 pF	189008-75	CM05ED111J03
C108	22 pF N750	189017-89	Erie 301-000-U2J0-220J
C113	12 pF	189085	CM05ED120J03
C114,C115	62 pF	189008-71	CM05ED620J03
C116,C117	2 pF	189017-20	CM05ED020J03
C201	110 pF	189008-75	CM05ED111J03
C202	22 pF, N750	189017-89	Erie 831-000-U2J0-220J
C203	2.2 pF	189017-14	CC220CK2R2C
C204	110 pF	189008-75	CM05ED111J03
C205	22 pF, N750	189017-89	Erie 831-000-U2J0-220J
C206	3.9 pF	189017-34	Erie 301-611-C0K-399C
C207	110 pF	189008-75	CM05ED11J03
C208	22 pF, N750	189017-89	Erie 831-000-U2J0-220J
C213	10 pF	189116	CM05ED100J03
C214,C215	51 pF	189098	CM05ED510J03
C216,C217	2 pF	189017-20	CM05ED020J03

REF DES	DESCRIPTION	PART NO.	SIMILAR TO

RESISTORS

All resistors are in ohms 1/4W 5% unless otherwise specified.

R101	9.1K	189200-12	RC07GF912J03
R102	47K	189229	RC07GF473J03
R103	180K	189238-37	RC07GF184J03
R105	2.4K	189489	RC07GF242J03
R106	560	189235	RC07GF561J03
R109	6.2K	189238-50	RC07GF22J03
R110	6.2K	189238-50	RC07GF622J03
R201	9.1K	189200-12	RC07GF912J03
R202	62K	189238-50	RC07GF623J03
R203	270K	189200-22	RC07GF274J03
R205	2.4K	189498	RC07GF242J03
R206	560	189235	RC07GF561J03
R209,R210	9.1K	189200-12	RC07GF912J03

6.2 MHz AUDIO DEMODULATOR PN 1808398-3

CAPACITORS

REF DES	DESCRIPTION	PART NO.	SIMILAR TO
C101	110 pF	189008-75	CM05ED111J03
C102	22 pF N750	189017-89	Erie 801-000-C0G0220J
C103	2.2 pF	189017-14	CC220CK2R2C
C104	110 pF	189008-75	CM05ED111J03
C105	22 pF N750	189117-89	Erie 801-000-C0G0220J
C106	3.9 pF	189017-34	Erie 301-611-COK-399C
C107	110 pF	189008-75	CM05ED111J03
C108	22 pF N750	189017-89	Erie 301-000-U2J0-220J
C113	12 pF	189085	CM05ED120J03
C114,C115	62 pF	189008-71	CM05ED620J03
C116,C117	2 pF	189017-20	CM05ED020J03

RESISTORS

All resistors are in ohms 1/4W 5% unless otherwise specified.

R101	9.1K	189200-12	RC07GF912J03
R102	47K	189229	RC07GF473J03
R103	180K	189238-37	RC07GF184J03
R105	2.4K	189489	RC07GF242J03
R106	560	189235	RC07GF561J03
R109,R110	6.2K	189238-50	RC07GF622J03

REF DES	DESCRIPTION	PART NO.	SIMILAR TO

7.5 MHz AUDIO DEMODULATOR PN 1808398-4

CAPACITORS

C101	82 pF	189008-72	CM05ED820J03
C102	18 pF, N750	189017-88	Erie 831-000-U2J0-180J
C103	1.5 pF	189008-1	Erie 301-000-C0K0-159C
C104	82 pF	189008-72	CM05ED820J03
C105	18 pF, N750	189017-88	Erie 831-000-U2J0-180J
C106	2.7 pF	189017-85	Erie 301-611-C0K-279C
C107	82 pF	189008-72	CM05ED820J03
C108	18 pF, N750	189017-88	Erie 831-000-U2J0-18OJ
C113	8 pF	18900-86	CM05ED080J03
C114,C115	39 pF	189097	CM05ED390J03
C116	1 pF	189017-13	CD15CD010D03
C117	2 pF	189017-20	CM05ED020J03

RESISTORS

All resistors are in ohms 1/4W 5% unless otherwise specified.

R101	9.1K	189200-12	RC07GF912J03
R102	27K	188078	RC07GF273J03
R103	110K	189238-58	RC07GF114J03
R105	2.4K	189489	RC07GF242J03
R106	560	189235	RC07GF561J03
R109,R110	12K	189492	RC07GF123J03

REF DES	DESCRIPTION	PART NO.	SIMILAR TO

8 MHz AUDIO DEMODULATOR PN 1808398-5

CAPACITORS

All capacitors are in picofarads unless otherwise specified.

C101	130 pF	189008-69	CM05ED131J03
C102	22 pF, N750	189017-89	Erie 801-000-C0G0-220J
C103	3 pF	189079	CD15503
C104	130 pF	185008-69	CM05ED131J03
C105	22 pF, N750	189017-89	Erie 801-000-C0G0-220J
C106	2.7 pF	189017-85	Erie 311-611-C0K-279C
C107	130 pF	189008-69	CM05ED131J03
C108	22 pF, N750	189017-85	Erie 801-000-C0G0
220J			
C113	15 pF	189117	CM05ED150J03
C114,C115	75 pF	189017-78	CM05ED750J03
C116	3 pF	189079	CD15503
C117	5 pF	189078	CM05CD050D3

RESISTORS

All resistors are in ohms 1/4W 5% unless otherwise specified.

R101	8.2K	189237	RC07GF822J03
R102	47K	198229	RC07GF473J03
R103	180K	189238-37	RC07GF184J03
R105	2.4K	189489	RC07GF242J03
R106	560	189234	RC07GF561J03
R109,R110	5.6K	189226	RC07GF562J03

REF DES	DESCRIPTION	PART NO.	SIMILAR TO

7.4 MHz AUDIO DEMODULATOR PN 1808398-6

CAPACITORS

All capacitors are in picofarads unless otherwise specified.

C101	82 pF	189008-72	CM05ED820J03
C102	18 pF, N750	189017-88	Erie 831-000-U2J0-180J
C103	1.5 pF	189008-1	Erie 301-000-C0K0-159C
C104	82 pF	189008-72	CM05ED820J03
C105	18 pF, N750	189017-88	Erie 831-000-U2J0-180J
C106	2.7 pF	189017-85	Erie 301-611-C0K-279C
C107	82 pF	189008-72	CM05ED820J03
C108	18 pF, N750	189017-88	Erie 831-000-U2J0-18OJ
C113	8 pF		
18900-86	CM05ED080J03		
C114,C115	39 pF	189097	CM05ED390J03
C116	1 pF	189017-13	CD15CD010D03
C117	2 pF		189017-20

RESISTORS

All resistors are in ohms 1/4W 5% unless otherwise specified.

R101	9.1K	189200-12	RC07GF912J03
R102	27K	188078	RC07GF273J03
R103	110K	189238-58	RC07GF114J03
R105	2.4K	189489	RC07GF242J03
R106	560	189235	RC07GF561J03
R109,R110	12K	189492	RC07GF123J03